MODEL AIRPLANE NEWS

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48120 July 1996

R/C Product Buyers' Guide

—see page 83

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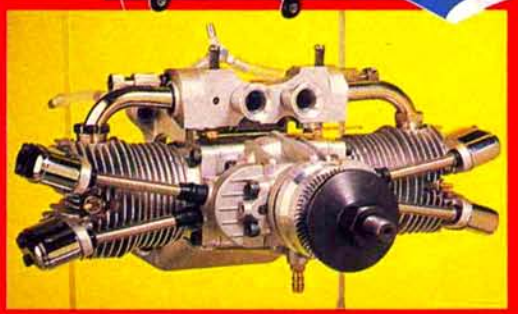

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MODEL AIRPLANE NEWS

JULY 1996 • VOLUME 124, NUMBER 7

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columns

ON THE COVER: *main photo—the new aerobatic Midwest Citabria comes in after another successful flight. Photo by Walter Sidas. Inset photos (clockwise): Ace R/C DigiPulse charger, Saito 182 4-stroke engine, Hitec Prism 7X computer radio, Robart retractable nose gear, Top Flite Gold Editon P-47 Thunderbolt.*

ON THIS PAGE: *the incredible Connie. Built by R/C World Flyers club member Eric Dern and flown by retired AMA President Don Lowe, the beautiful Lockheed Constellation was the hit of the R/C World Big-Bird Fly-In.*

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EDITORIAL

by GERRY YARRISH

ANSWERS FOR BUILDERS

The universal constant that binds modelers together is balsa. The vast majority of the models we build and fly are built of nature's wonder wood. As with any material, to use it to its full potential, that is to say, use it *correctly*, you need to fully understand its properties. Mistakenly using balsa that's too soft or too hard for a given building job is a real pain, but more important, using the wrong grade of balsa can greatly affect a model's structural integrity. "Which type of balsa should I use to build my model?"—a very common question, especially among newcomers to R/C. Hear the answer in this month's "Scratch Builder's Corner," in which George Wilson teaches us the ABCs of building with balsa.

Rich Feroldi's impressive, 100 inch span WW1 German Albatros takes off for another sortie at the 1996 R/C World Big Bird Fly In.

1996 BUYERS' GUIDE

This month, we're proud to bring you the *1996 Model Airplane News Buyers' Guide*. Designed to help you make those important purchasing decisions, it's filled with more than 400 of the top R/C airplane products on the market divided into 15 sections. For your convenience, we've also included a handy index of up-to-date manufacturer addresses and phone numbers at the back. Whether you're a sport flier or a scale builder, we know you'll be thumbing through the *1996 Buyers' Guide* for many months to come.

FUN IN THE SUN

For years, I had heard about it, but until recently, I never had a chance to visit R/C World in Orlando, FL. It's the home base of the R/C World Flyers—a combination of condominiums and R/C modelers' heaven—and it's a great place to spend a few days when winter starts to get to you.

Created in 1981, R/C World is the brainchild of some visionary modelers who pooled their money to invest in the then affordable Florida real estate. *Model Airplane News* also contributed—interested in establishing a place in the sun where retired modelers would live and be able to fly their models. Approximately 100 acres surround their 450-foot runway, so the R/C World Flyers have a great place to put on their annual Big-Bird Fly-In.

This year, some of the country's top fliers showed up and enjoyed the great facility and a weekend of low-key flying—and fun!—held in honor of retiring AMA President Don Lowe. As you'll see from our event coverage, from a giant-scale Lockheed Constellation to free-style aerobatics and R/C candy drops, there was something for everyone.

BIGGER, LIGHTER MODELS?

This month, in "Scale Techniques," Bob Underwood raises questions and supplies some answers about the size of our models and their wing loadings.

Did you ever consider that the scale to which you build a model can indirectly affect its flight performance? Larger models tend to fly better, as do planes with lower wing loadings. As it happens, smaller scale models tend to have higher wing loadings. Bob shows how you can build a larger model with only a slight increase in weight and enjoy a good *decrease* in wing loading. Will it fly better? You bet! Check out Bob's column and avoid the pitfalls that lie in wait for your next scale project.

And for aerobat scratch-builders, we have a sport-scale, two-place, Sukhoi Su-29 for your next project. Designed by Mark Sirianni, this 80-inch-span, .90-size model looks great and flies beautifully.

PILOT TALK

Jeff Powell of Hurst, TX, has been flying for 22 years. He got started in giant scale because he's always been impressed by the range of capabilities big planes have in aerobatics:

I fly a 35% Pirate Extra 300S that weighs in at about 27 lbs, wet. I started by powering it with a Precision Eagle 4.2 TOC version with all the bells and whistles, and later with a 5.8.

I was really pleased with the power I got from these engines until I got a side-by-side comparison with a Quadra. Now, I'd never go back to a Sachs.

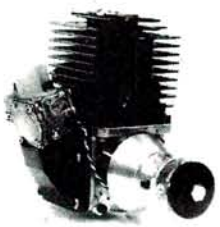
First I had a Quadra Q75, 4.4 cubic inches. It was able to turn bigger props at faster RPMs than my 4.2, important for doing maneuvers like torque rolls.

I've also got a 6.0-inch Q100 that I fly most of the time. Both really put out the power. Talk is cheap, I always say; the proof is in the pudding. I also like to mix metaphors.

These pups perform. I'm swinging a 24x12, and I can hover perfectly vertical while maintaining a constant RPM. But what's most impressive is how I can accelerate out of the torque roll and get unlimited vertical from the Quadra.

It does better climbing out than a 5.8: "unlimited" and "vertical" are words you seldom hear together with a 27-pound plane. With my Quadra, you just keep on truckin'. Up.

I prefer battery ignition, but some of my friends like the fact that Quadra also makes a magneto version, with a spring starter installed at the factory. So if you're looking for the best, get a Quadra. They're available, they're a great value, and they perform. I think you'll like them better than anything you've ever flown.



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AIRWAVES

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INQUIRING MINDS

Your April '96 *Model Airplane News* is outstanding. I particularly enjoyed the P-40 and Hawker Tempest articles, and my curiosity has spawned two questions.

First, I am awed by Sepp Uiberlacher's Tempest. What a masterpiece! But, really, how long did it take to build? In the article, Mike Cherry wrote that the rivets took Sepp "three weeks of full-time work. That's more than 300 hours just for the rivets." Is Mr. Cherry using new math, or did Mr. Uiberlacher really work 100+ hour weeks? It is also written that the model took 3,000 hours to complete. Is that 30 weeks or something much longer?

Second, I'm building a Top Flite P-40, and I loved Stephen Scotto's Field and Bench review. I am also puzzled: on page 38, one picture shows the area between the sets of teeth painted red above black, but the other picture shows just the opposite. How did that happen?

I'm just curious, puzzled and would really like to know.

BOB HUSK
fourdog@ix.netcom.com

Bob, although it may seem hard to believe, many top modelers sometimes—including Sepp—spend more than 100 hours a week on their aircraft. The 3,000 hours that Sepp spent on the Tempest was spread over more than two years. This also includes the initial design and documentation.

As for your second question: during the first photo shoot, Stephen nosed the P-40 (which had the correct version of the mouth) into the ground during a hard landing. When he rebuilt the model, he inadvertently swapped the black and red sections of the shark mouth, which explains the red above black in subsequent photos. You have a sharp eye! DS

PHILIP AVONDS KITS

I was very impressed with the coverage of the Superman Fan Fly in your April '96 issue. Although I was unable to attend, my representative Pat De Filippis attended and agreed that it was a great event.

I would, however, like to correct an error in the article. Rich Uravitch reported that Lesher Model Aviation now sells the Philip Avonds F-15 Eagle and Dassault Rafale. This is a mistake. Aeroloft Designs and our dealers are the sole U.S. providers of the Philip Avonds designs. As a matter of fact, the F-15 Eagle, Rafale A and the F-104 Starfighter are now manufactured under license by Aeroloft Designs right here in Arizona.

We want to make it very clear that Lesher Model Aviation is in no way affiliated with Philip Avonds, the Philip Avonds designs, or Aeroloft Designs and their manufactured kits.

STEVE SLACHTA
President, Aeroloft Designs

FROM RUSSIA WITH LOVE

I'm an avid fan of your magazine, which I consider to be one of the best in its field. Yet I've never had a chance to read any news on airplane modeling in Russia (or in any other former Soviet Republic, for that matter). It might seem that this activity is of no interest to the inhabitants of one sixth of the world. This is definitely not the case. As an example, I would like to share with your readers some of my personal experience in this field.

For the last 25 years, I've been engaged in airplane modeling with my neighbor and close friend Basil Gurov. Airplane-modeling clubs have been popular—especially with teenagers—in my country since the late '20s. Recent changes in Russia have opened our channels of communications with the rest of the airplane modeling world (we were finally able to subscribe to your magazine, for one thing). Another significant change for us came with the fall of Communism five years ago, when the government finally lifted the ban on the operation of radio-transmission devices by private citizens. This allowed us to switch from CL to R/C models.

We build our models during the long, cold Russian winters and test-fly them in the summer at the Khodynka Airfield, which is located in downtown Moscow near the Aerostar Hotel (very popular with visiting U.S. government officials and contractors).

Until recently, we've been building R/C trainers with 6.5ci engines. This winter, we plan to build Curare and Extra 300 models (both have 1,800cm wingspans and 10ci engines). We've also purchased an Su-29 Sukhoi model kit that we plan to equip with a 20ci engine, since we came to the conclusion that big models are the best.

Moscow is bustling with all sorts of airplane modeling activities. There is a club, and competitions are held regularly. We would be glad to become your correspondents and describe those activities in more detail. Feel free to contact us.

DMITRY BATENIN
Baikalskaya ulitsa, 44-2-36; Moscow, 107497, Russia
fax 7-095-956-2686; e-mail: kontactam@glas.apc.org

WHAT'S IN A NAME?

The "Name That Plane" answer published in the April '96 issue further blurs the distinction between the Bellanca Airbus (ATC 391, issued January 26, 1931) and the Bellanca Aircruiser (ATC 563, issued March 16, 1935). Apart from their vertical fins and window patterns, they looked a lot alike.

The plane in the photo was Airbus Serial no. 702, originally built as a 12-passenger P200. Equipped with EDO floats, it became the P200A, the basis for my R/C design (*Model Airplane News* plan no. FSP10902). When single-engine airliners were banned in 1934, it was refurbished as the 15-passenger P300 Airbus and sold abroad.

You may owe a clarification to the many scale buffs who bought those plans!

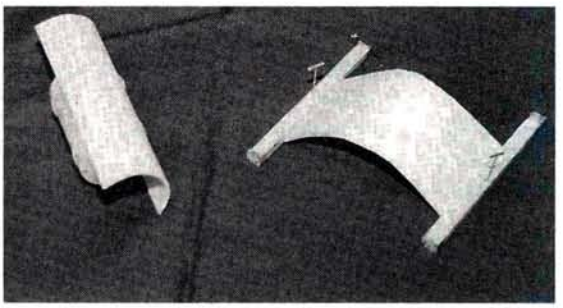
STEVE RUTZ
Muskegon, MI

Stan, our reader responses were split down the middle: half said Airbus; the other half said Aircruiser. Using the 1933 volume of Jane's "All The World's Aircraft," we mistakenly identified the plane as an Aircruiser. Thanks to you and a few other readers, the proper identification has been made; the photo we printed was indeed of an Airbus. Sorry for the confusion. RP

Scratch-Builders' CORNER

by GEORGE WILSON JR.

CHOOSING WOOD FOR BETTER MODELING

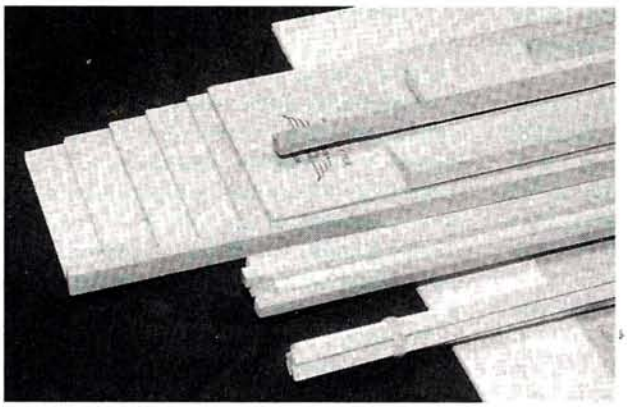


Balsa bends most easily along its grain. After being soaked in a 50:50 solution of ammonia and water, it bends fairly easily. (Use a water-soluble glue on damp wood.) The photo shows bends going with the grain and across it. Note the cracks in the cross-grain bend (the wood samples were cut from the same sheet).

AS SCRATCH-BUILDERS, one of our primary concerns is which wood we should choose for particular parts. Woods vary with respect to strength, weight, and how easy they are to work with and bend. Heavier woods are stronger, but they weigh more, so we have to decide which characteristic is more important for a particular part and choose the wood accordingly.

This article applies to R/C models of medium size, but most of the information given can be applied to models of all sizes.

Balsa, spruce, birch (dowels), lite-ply and aircraft-grade (hardwood) plywood are all readily available from your hobby shop and mail-order suppliers, and they'll satisfy all your model-building needs. In other countries, obechi and basswood are popular, and you'll see them used in foreign kits. Pine (a soft wood) can also be useful: I occasionally use it for internal parts that require strength and little finishing, because it's relatively strong, fairly light and inexpensive. (You'll need a table saw and a fine blade to cut it to size.)



A typical collection of sheet and stick woods bought for scratch-building. Balsa, spruce, hardwood plywood and lite-ply are included; they'll become part of an OV-10 Bronco built from Model Airplane News plans.

BALSA

Because this is *the* traditional model-building wood, most of this column discusses its features and uses, and I compare other woods with it. It comes in different weights and grains, both of which are important. The skill lies in selecting the correct type for a particular application.

It comes in strips, sheets and blocks, and scratch-builders frequently cut strips off sheets with one of the many available stripping tools.

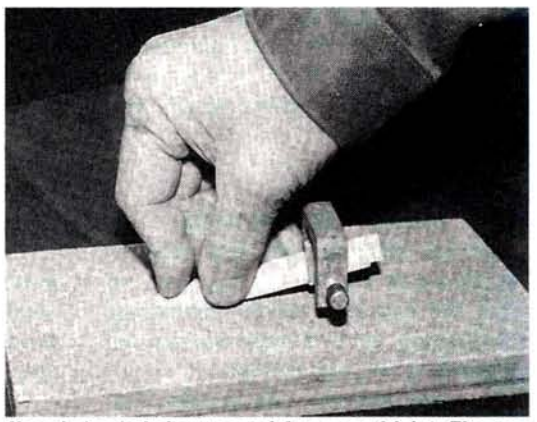
Sheet balsa should be selected according to its intended use. It bends most easily *with* the grain. To bend it around compound curves, cut it into thin strips and apply it as planking. To make it conform to complex or very pronounced curves, e.g., when making laminated wingtips, or even the curvature in the top forward wing sheeting, first soak it in water or, even better, a 50:50 solution of water and ammonia. Then glue the wet balsa with a water-soluble glue (typically, an aliphatic-resin type), and allow it to dry thoroughly.

Features

- Light but relatively strong.
- Easily cut and shaped with simple bench tools.
- Readily available in a wide range of sizes and weights.
- Easy to bend—an important consideration in model building.
- Easy to dent and crush—a unique strength feature—so it will absorb energy in a crash, and this will limit damage incurred by expensive parts such as the radio and engine.
- Easy to repair. You can remove dents from unfinished balsa by wetting the dented area. Repair damaged areas by cutting them out and gluing new balsa into the voids. At the field, you can often pull the broken balsa back into shape and glue it with epoxy or CA.

Weight

Comes in weights of from 4 to 16 pounds per cubic foot.



PHOTOS BY GEORGE WILSON JR.

Here balsa is being tapered for a scarf joint. The two ends are clamped together to ensure an equal angle on each. A belt or disk sander can also be used for this operation. (See the main article for more information on joining balsa pieces.)

• **Light**. Use the lightest for indoor models; I have successfully used it for wing and tail sheeting on light R/C models.
• **Medium**. Ten- to 12-pound balsa is the most readily available and is most useful in models of medium size.
• **Heavy**. The heaviest balsa is hard to find in model shops.

Grain

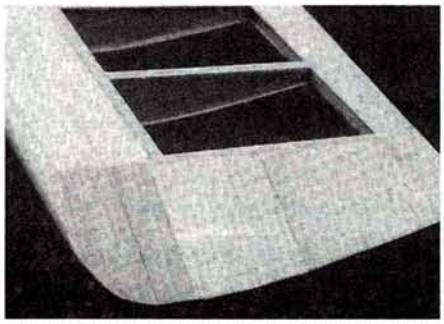
See Figure 1. Choose balsa with long, straight grain lines; it's least likely to split when bent, and it bends easily along its grain. In its catalogue, Sig Mfg. shows pictures of the various grains and says what each is best used for. When selecting balsa, this catalogue makes a good starting point.
• **A-grain**—light to medium; used for curved surfaces such as wing and tail sheeting and capstrips.
• **B-grain**—medium to very hard; widely used for ribs, bulkheads, tail structures and wingtips.
• **C-grain**—very hard; used for flat surfaces such as wing leading edges and fuselage longerons.

Glues and finishes

When it's coated with dope, balsa becomes much harder, but with minimal weight increase. If you plan to finish it with an iron-on covering, there are coatings available to ensure good adhesion. After finish-sanding, I apply a couple of coats of nitrate dope (butyrate is acceptable) thinned 50 percent and then the prep coat—typically, Balsarite* or Sig Stix-It.

Balsa basics

• Like most woods, when it's wet balsa tends to warp, and it also does so when it has been cut into strips. This is caused by its internal stresses being relieved. To counteract this, wet your balsa and hold it bent in the opposite direction until it has dried. Usually, an equal and opposite bend does the trick.

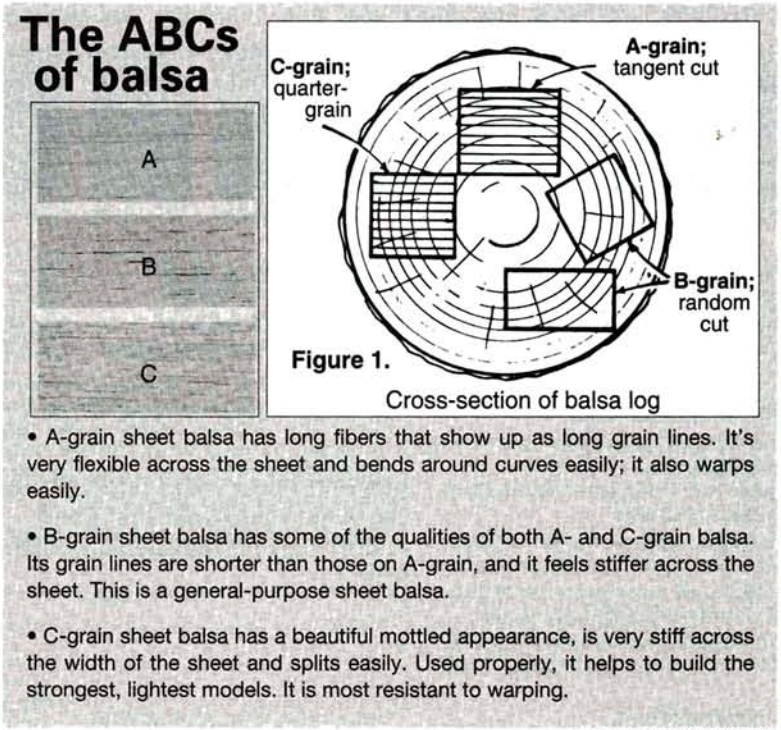


Examples of A-grain (straight, long) and B-grain (straight, but shorter) balsa used for flat and curved wing sheeting. (See the article on the Livewire II—December '95 issue).

• The edges of sheets that must be butted against each other (as when joining sheets for wing sheeting) should first be cut straight with a straightedge of the appropriate length—a *real* straightedge (most yardsticks are not truly straight). Bear in mind that if you wet the sheet after you've straightened its edge, it may curve again.
• When sheeting a wing, avoid making butt joints against wing leading edges. The structure should be designed to allow the sheeting to overlap the edge; trim it after the glue has dried. The rear edge of wing's forward sheeting does not have to be straight if it butts up against the rear capstrips.
• If you have a sheet in which there's a long, grainwise split, you can repair it with aliphatic resin or CA. Glue the split balsa over wax paper, and pin it carefully to eliminate the gap. If it is glued to the structure (ribs or formers), the split won't be detectable, and strength will not be compromised.
• Most scratch-builders are frugal (read: cheap?), so they splice scrap balsa pieces together to make pieces in the lengths and sizes they want. After they've been sanded and finished, well-made joints are invisible, and they are as strong as the unspliced material. Splices work best when they are placed over part of the structure, e.g., a wing rib or a fuselage upright. The diagonal scarf joint is recommended for both sticks and sheets.

When you work with sheets, use a scarf angle of about 45 degrees. Scabs are permitted (a secondary piece glued across the joint to strengthen it). In a stick, the angled scarf cut should be long enough to ensure that the length of the overlapping joined area is several times the width of the stick.

Butt joints are unreliable and should be avoided. If you must use one, reinforce it with a strong scab. To repair a break, make a good butt joint at the broken edges by wetting them thoroughly with glue; then push them together and hold them until the glue has dried. For scabs, spruce—the next wood I'll talk about—is more suitable.



SPRUCE

Spruce sticks are readily available in sizes from 1/16 to 3/8 inch thick. Spruce is most often cut with a razor saw, and it should be spliced in the same way as balsa. Aliphatic-resin glue, which dries slowly, is recommended because of the time required for this dense wood to absorb the glue. Sheet spruce is not normally available.

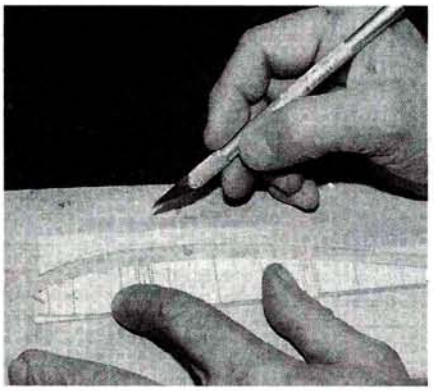
Features

• It's denser, so it's about twice as heavy as medium-weight balsa, but it's much harder and, therefore, stronger. The Sig catalogue

claims spruce is 10 times stronger than balsa, but it doesn't define which type of strength is being assessed.

• Not easy to bend. My simple test comparison of samples of 1/4x1/8-inch balsa and spruce indicated that it took five times as much pressure to bend spruce as it did balsa.

• Resists being crushed.



Ribs can be cut using a pattern, as shown in this photo. Although I've tried other ways of making ribs, I prefer this old-fashioned approach. Rib blanks can be stacked and then cut on a band saw or jigsaw. (Make sure the blade is at right angles to the table.) A rib-shaped block may be cut on a saw, and then the ribs may be sliced off with a saw. A friend of mine uses a router to produce smooth, accurate ribs from a pattern.

Uses

• Most useful for wing spars and fuselage longerons. These can be made with thinner, lighter, spruce sticks than if you were using balsa. A 1/16x1/4-inch spruce spar may be used in place of a 1/4-inch square, medium-weight balsa spar, and it will weigh only half as much.

• Great for scabs.

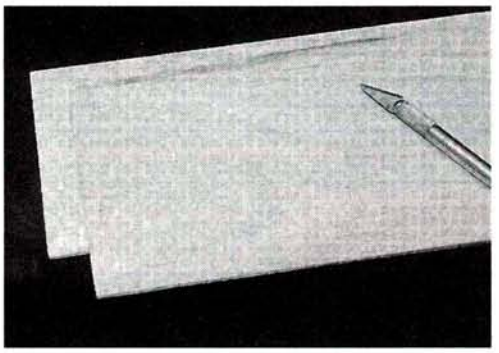
BIRCH

The dowels we use are most often made of birch, which is strong and relatively heavy. Birch dowels are used for wing tie-downs and to position removable parts of models.

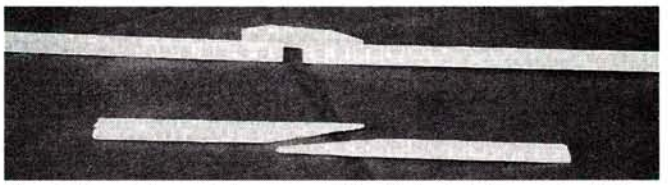
Like spruce, birch should be glued with a slow-drying glue that will be absorbed by the wood; poorly glued, badly fitted dowels come loose—as we all know from experience! To ensure that the rubber bands do not slip off the wing-tie-down dowels when the wood is coated with fuel residue, the dowels should project an inch or more beyond the fuselage.

POPLAR

Lite-ply is most often 1/8 inch thick and made of three plies of poplar. Lite-ply sheet is stronger than balsa, and it weighs about twice as much as medium balsa. It can be cut fairly easily with a hobby knife, but a motor-driven jigsaw is the tool of choice.



Typical sheet balsa; both pieces appear to be B-grain (random cut). This type of wood is widely used in model building. The stain on the bottom piece is no threat to its usefulness. A-grain was cut with the tree rings and has a long, straight grain lines. C-grain has a mottled grain and is stiff across the sheet. It splits easily because it was cut across the tree rings.



Here, balsa sticks are being prepared for joining. The top stick will have a scab to reinforce the butt joint. The lower joint is a scarf or tapered joint; this is the preferred method of joining both stick and sheet wood. Good joints in wood are at least as strong as a continuous piece.

When used for fuselage sides, lite-ply is much less easily dented than balsa. That it's more difficult to die-cut is evident in the crunched edges that show up on the lite-ply parts in some kits. Lite-ply is recommended for fuselage doublers (inside) where it adds strength without a serious weight penalty.

HARDWOOD PLYWOOD

This has great strength, but it's heavy, so it's most useful where great strength and abrasion-resistance are needed. It comes in three, four and five plies. One sample of three-ply, 1/32-inch-thick plywood weighed 53 pounds per cubic foot—about five times the weight of medium balsa. Aircraft-grade plywood is readily available in thicknesses of from 1/64 to 1/4 inch; the 1/64-inch wing-skin material has three plies.

Typically, plywood is used for the firewall that supports a model's engine and also to support landing gear. It may be drilled accurately to take close-fitting machine screws and rubber engine-vibration isolators.

Like spruce and birch, hardwood plywood is best attached with a slow-drying glue such as aliphatic-resin or thinned epoxy, both of which are fuelproof and will soak into the plywood layers.

NEXT TIME

How often have you heard: "What size should my wing spars and longerons be?" and "What's the best thickness for the wing or fuselage sheeting?" Most often, answers to these questions will be based on experience gained from building previous designs. Most of us don't have the talent, time, or resources to pick wood sizes scientifically. As a result, most models are over-designed from the strength standpoint (assuming that they have not been designed specifically for maximum crash-resistance).

The most common in-air failure is the collapse of the dihedral wing joint because of a violent maneuver—intentional or not. I have designed and flown trainer wings with structures so light that I felt they would fail, but they didn't. To select wood for your model, my advice is to try the wood dimensions that are used in similar models that fly well.

In a future column, I hope to discuss structural designs that maximize strength and minimize weight. Until then, keep building.

**Addresses are listed alphabetically in the Index of Manufacturers on page 184.*

Suppliers for Scratch-Builders

Balsa USA, P.O. Box 164, Marinette, WI 54143; (906) 863-6421.

Global Hobby Distributors, 10725 Ellis Ave., Fountain Valley, CA 92728; (714) 964-0827; fax (714) 962-6452.

Hobby Lobby Intl., 5614 Franklin Pike Circle, Brentwood, TN 37027; (615) 373-1444.

Lone Star Balsa, Rte. 9, Box 437, Lubbock, TX 79423; (806) 745-6394.

Midwest Products Co. Inc., P.O. Box 564, Hobart, IN 46342; (219) 942-1134.

National Balsa, 97 Cherokee Dr., Springfield, MA 01109; (413) 796-1925.

Sig Mfg. Co. Inc., 401-7 South Front St., Montezuma, IA 50171; (515) 623-5154.

Superior Balsa Aircraft Materials, 12020-G Centralia, Hawaiian Gardens, CA 90716; (310) 865-3220.

Tower Hobbies, P.O. Box 9078, Champaign IL 61826-9078; (217) 398-3636.

Trillium Balsa Ltd., 260 Tilsonburg, Ontario, Canada N4G 3B5; (519) 688-3522.

AirSCOOP

by CHRIS CHIANELLI

New products or people behind the scenes; my sources have been put on alert to get the scoop! In this column, you'll find new things that will, at times, cause consternation, and telepathic insults will probably be launched in my general direction! But who cares? It's you, the reader, who matters most! I spy for those who fly!

Ra-fun

(pronounced Raven)

Here are Karen and Wayne Handley with their famous full-size Raven and Global's new Raven 40 Fun Fly profile stunt plane. The Raven 40 Fun Fly performs outrageous aerial contortions, such as square knife-edge loops, floating flat spins, rapid-fire rolls and hovers; it even lands backward in a breeze and does the infamous "Flea Flicker" maneuver. Karen's and Wayne's smiles say it all: they approve! In fact, they were so enamored with Global's Fun Fly Raven that they decided to build the full-scale version, and it's almost complete. Wayne confided in me that the profile fuselage was causing cockpit-design problems; however, he's confident that he can solve them.

Specifications: wingspan—53 inches, area—828 square inches, weight (without radio)—54 ounces, engine required—.40 to .53 2-stroke.

• Global Hobby Distributors, 18480 Bandilier Circle, Fountain Valley, CA 92728-8610; (714) 964-0827; fax (714) 962-6452.

Pacer's Hinge Glue

The Zap gang's latest creation is a specially formulated, non-CA glue that will secure *any* hinge to *any* material. Pacer's "Hinge Glue" features an incredibly handy applicator for easy hinge installation. Hinge Glue is half the price of CA, and it gives the builder a longer working time, which is often needed to align critical control-surface hinge joints. A 1-ounce bottle retails for $2.99. If Hinge Glue or any other Zap product is not available in your area, call one of the following Zap offices, and they will put you in touch with the nearest supplier: Frank Tiano Enterprises (East Coast), (407) 795-6600; Robart, Inc. (Midwest), (708) 584-7616; House of Balsa (West Coast), (619) 246-6462.

THUNDER TIGER Pro 1.20

It appears that the 1.20 2-stroke has definitely carved out a place for itself in the hearts of the experienced, and not so experienced, sport and scale modelers. One need only take inventory of the recently released designs for this size engine to dispel any doubts. Thunder Tiger has certainly established itself as a maker of high-quality performance engines, and the introduction of their new 1.20 2-stroke is sure to be good news to you modelers, whether you're into sport, pattern, or scale. One very trick feature of this new engine is that the muffler can be firmly bolted on in both standard and Pitts-style positions. Other features include a ringed piston, dual ball bearings, a twin-needle carb (with reduced mixture sensitivity) and Thunder Tiger's three-year warranty. The "street" price will be somewhere around $250. Watch for the rear-exhaust, pumped version sometime in July.

• Thunder Tiger USA, 2430 Lacy Ln. #120, Dallas, TX 75006; (214) 243-8238; fax (214) 243-8255.

WHERE NO PLANE HAS GONE BEFORE

If there ever was a plane that penetrated the frontier on a regular basis, it was the venerable deHavilland Beaver. Now you can hone your R/C bush-piloting skills with Global's new deHavilland Beaver 40 and, with its high-aspect ratio, high-lift, flat-bottom, 64-inch wing and a set of floats, you can do some R/C island hopping of your own. If the cold weather doesn't bother you, slap on a set of skis, and get ready for tundra takeoffs Admiral-Byrd-style. Global's new Beaver features working cabin doors, scale windows and wing struts that are not only functional but also add exciting authenticity. Included optional flaps (requiring a fifth channel) are the icing on the cake of realism. And with that big radial cowl, any .40 to .53 2-stroke with Pitts-style muffler or appropriately sized 4-stroke will be nicely hidden from view. The scale fun factor on this design is very high indeed. Gee, can you tell I really like this one? It's something different that should prove to be a great flier. The kit features sturdy, lightweight, all-balsa construction; top-quality machine and die-cut parts; self-jigging tab and slot alignment; extensive hardware; a fiberglass cowl; rolled plans; and a photo-illustrated manual.

• Global Hobby Distributors, 18480 Bandilier Circle, Fountain Valley, CA 92728-8610; (714) 964-0827; fax (714) 962-6452.

NEW SURPASS

The all-new FS-52S is the latest addition to the popular O.S. Surpass line of 4-stroke engines. The new engine reportedly delivers 12 percent more power than the already powerful FS-48 Surpass, and it's the same size and weight. The 52S features a new Type 40N reversible carburetor with automatic mixture control for more stable idling. The 52's crankshaft, camshaft and piston ring have been treated with a corrosion-resistant coating while the rear ball bearing is rubber-sealed for improved durability. Other features include a redesigned silencer to reduce noise more effectively and a new prop locknut that helps prevent props from spinning off. • Great Planes Model Distributors, 2904 Research Rd., Champaign, IL 61826-9021; (217) 398-6300; fax (217) 398-0008.

Super Phatic

What does it do? According to the distributor, Hobby Lobby International, Super Phatic glues wood together better than any other glue. Why?—because it flows inside of the two pieces of wood to "grab" hold of the grain and bond the pieces so well that they can be separated only by breaking them. In essence, it seeks out places to bond and makes a joint stronger than the wood itself.

Super Phatic looks like watery yellow or white glue, but it isn't. It's much stronger than normal white glue, and when it sets, it's almost weightless. It doesn't set as fast as CA, but it's reported to be stronger. If you try Super Phatic and don't like it, send it back to Hobby Lobby, and they'll give you a cash refund. A 50ml bottle is $5.95.

• Hobby Lobby Intl., 5614 Franklin Pike Circle, Brentwood, TN 37027; (615) 373-1444; fax (615) 377-6948.

Ultimate Series™

Following on the heels of Balsa USA's very successful 1/3-scale J-3 Cub comes this new Ultimate Series™ 1/3-scale Piper Super Cub kit that's made with Balsa USA's accurately jig-cut balsa and ply and their exclusive Fall-Out™ die-cut parts. In the Ultimate Series tradition, the Super Cub comes with all the necessary hardware: exact-scale landing gear, scale wheels, leaf-spring tailwheel, fuel tank, scale decals, pinking tape, socket-head bolts, aircraft locknuts, Kwik-Links and all preformed scale fittings; even a separate plan for rib-stitching and pinking-tape detail is included. With everything in the kit, there's no reason why you can't create a masterpiece of your own. Like its J-3 brother, the Super Cub's flight performance should be breathtakingly realistic. Specifications: wingspan—140 3/4 inches, weight—30 to 35 pounds, length—88.75 inches, wing area—3,051 square inches, power—2 to 4 cubic inches.

• Balsa USA, P.O. Box 164, Marinette, WI 54143; (800) 225-7287; fax (906) 863-5878.

Happy 50th Anniversary!

Balsa USA started manufacturing kits with the introduction of a twin-rotor helicopter kit in 1946 under the name Joy Products. Throughout the '50s, the company produced 1/2A control-line kits, such as the Pee Wee Pursuit, Pee Wee Pup and Stunt Runt. In the '70s, they started to produce R/C kits and changed their name to Balsa USA in '75. *Model Airplane News* wishes Balsa USA and owner Ron Bush another 50 years of success and thanks him for serving the industry by bringing the modeler high-quality balsa kits at truly amazing prices.

Pilot PROJECTS

A LOOK AT WHAT OUR READERS ARE DOING

SEND IN YOUR SNAPSHOTS

Model Airplane News is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable. We receive so many photographs that we are unable to return them.

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of 1996. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897-3035.

FLYING FIRST CLASS

Nestor Navarro of Lake Park, FL, entered this Great Planes Gates Learjet in the South Florida Fair R/C Model contest and won Best Civilian Aircraft and Best in Show. He painted the fuselage and wing tanks with epoxy and covered the rest of the jet in MonoKote; the numbers on the fuse are computer-generated, and the remaining decals came with the kit. Powered by a SuperTigre .45 2-stroke swinging a 10x6 prop, the plane is very stable and achieves speeds of 70mph when the Spring Air gear is retracted.

CANADIAN BEAVER

Simon Martel of St. Prime, Quebec, Canada, scratch-built this scale deHavilland Beaver from his own plans after having only two years' experience in R/C. The 12-foot model is made of balsa, plywood and foam and is powered by a 62cc Zenoah engine. Très bien, Simon!

IRON ANNIE

This Hobby Lobby Junkers 52/3m was built by Gary Grollimund of Chesterfield, VA. He hand-cut the corrugation lines (10 per inch) on the fuselage and vertical and horizontal stabilizers. Painted with Pactra acrylic flat paint (Gary handpainted the insignias), the Ju 52 has right and left defensive gun positions and a top rear gun port on which there's a scale MG 34; and it also has functional flaps and ailerons.

OLD CROW

Roger McClellan of Nashville, TN, sent this photo of his 1/7-scale Top Flite P-51D. It has sequenced landing-gear doors with Century Jet retracts and functional flaps and drop tanks, and it's powered by an O.S. 1.20 4-stroke engine. The model is finished in aluminum sheet from Jeff Foley, and it sports an Aero FX Old Crow emblem.

GENTLE GEORGE

William Clay of Baytown, TX, scratch-built this low-wing Japanese N1-K2J George. The fully sheeted model is covered with 3/4-ounce fiberglass and resin; it's equipped with Rhom Air retracts with restrictors to make it move in a more scale-like fashion. An ASP 1.08 engine swinging a 15x8 Master Airscrew prop flies the plane smoothly.

MODEL AIRPLANE NEWS HOW TO

by MIKE McCONVILLE

STOP Common causes and practical fixes Control-Surface Flutter

FLUTTER IN YOUR RUDDER—or in any control surface for that matter—usually produces disastrous results. There are many factors that can cause flutter. This month, I'll look at control-system setup and examine the most common causes of, and practical remedies for, control-surface flutter.

Aileron flutter destroyed and separated this airplane's wing panel during flight. Here's the end result of wing separation during flight.

WHAT'S FLUTTER?

Flutter is the unwanted oscillation of a control surface in flight. Depending on its severity, flutter can range from a barely audible hum to a trailing edge that looks like a complete blur. The outcome always results in some type of failure—a broken linkage, stripped servo gears, failure of hinges or of the structure to which the fluttering control surface is attached. The result is a seriously damaged airplane. The causes of flutter can be very subtle and easily overlooked. How many times have you seen two seemingly identical airplanes, but one worked well and the other had a flutter problem?

AN OUNCE OF PREVENTION

Before flying any new airplane, seal the control-surface hinge gaps. Often, the hinging seems to leave a gapless connection, but no unsealed gap is completely airtight. Always seal the gap, regardless of how tight it may seem. This reduces the possibility of flutter and results in more positive and effective control of the model. (I consider this step a normal part of building.) Gaps can be easily sealed from the bottom of the surface with a strip of iron-on covering (see Figure 1).

CONTROL-SURFACE TWIST

The twist might have been good for Chubby Checker and might even be a good tune for flying a freestyle routine, but it isn't good for a control surface. Twist or torsional flex in a control surface often occurs in a long, solid, balsa surface, such as a strip aileron. If the balsa is too soft, the surface may easily flex and act as if it's disconnected from its linkage. You should replace extremely soft, flexible balsa control surfaces. I've seen this happen many times on Quickie 500 racers because of their high speeds and very light airframes. A very easy fix is to partially tape (use a flexible tape, such as 3M clear decorator tape) the underside of the aileron tip to the fixed portion of the wing (see Figure 2). This makes the surface twist somewhat when it's deflected, but it usually doesn't result in a loss of control rate. This method also works well on Sunday fliers.

MASS BALANCES

The need for mass balancing is much greater on larger models. The bigger a control surface is, the more mass it has. As the surface mass increases, so does its inertia. In practical terms, this means the heavier the control surface

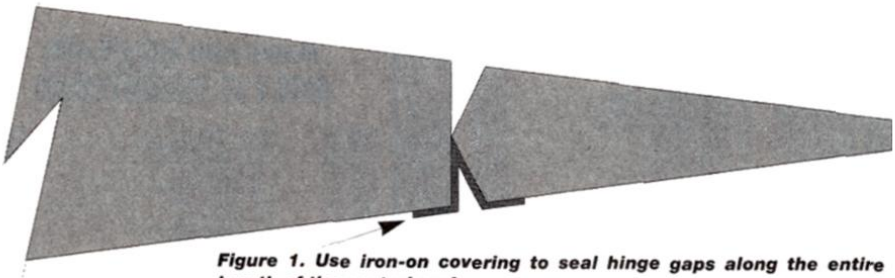


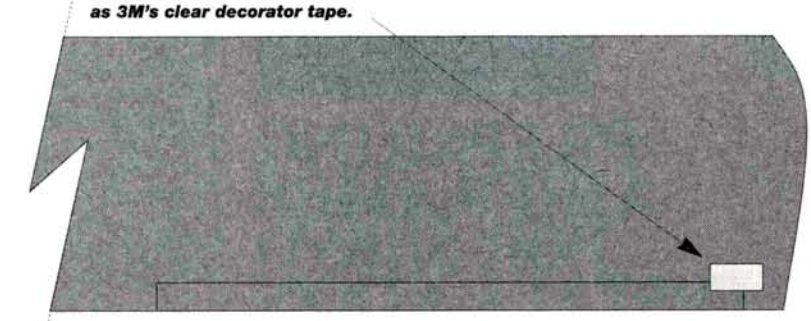
Figure 1. Use iron-on covering to seal hinge gaps along the entire length of the control surface.

is, the more its mass will contribute to the surface oscillation. After a point, the linkage system can not overcome the surface load, and flutter will occur. I've often heard people say that they had beefed up the control surfaces to stiffen them but they still fluttered. In reality, beefing up the control surfaces increases the surface mass, which causes flutter. Mass or counter balances are simply the addition of weight to the control surface ahead of the hinge line so that the surface balances level or at least close to level when it's disconnected from its linkage. On models that have counterbalances as part of the control surface, balancing can be achieved by adding weight to the control surface ahead of the hinge line. Figure 3 shows this type of setup on the elevators of the new Midwest* Giles G-202. On models that have a straight hinge line, a balance can be added to the bottom of the control surface. As shown in Figure 4, a balance can be added to the control horn. If the flutter is not caused by unsealed hinge gaps, a flexible twisting surface or an improper linkage setup, mass balancing will almost always cure the problem.

In conclusion, if flutter is detected, land immediately, and take measures to correct the problem. Flutter's destructive force can literally tear an airframe apart; we all put too much time and effort into our models to take unnecessary risks.

**Addresses are listed alphabetically in the Index of Manufacturers on page 184.*

Figure 2. To eliminate flutter that results from excessive twisting, tape part of the bottom side of the control surface to the fixed surface. Use a flexible tape, such as 3M's clear decorator tape.



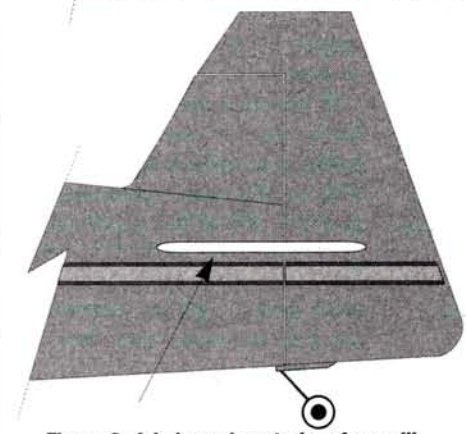
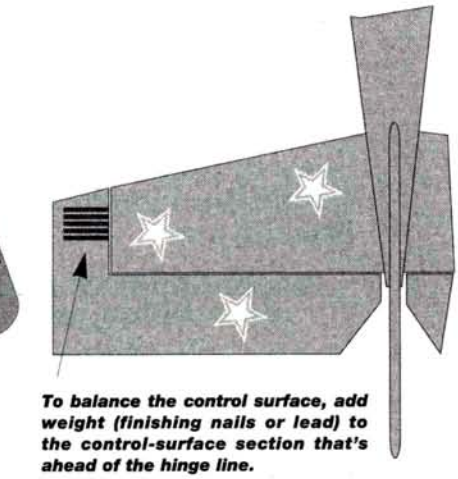


Figure 3. A balanced control surface will move to the neutral position when the linkage has been disconnected.



To balance the control surface, add weight (finishing nails or lead) to the control-surface section that's ahead of the hinge line.

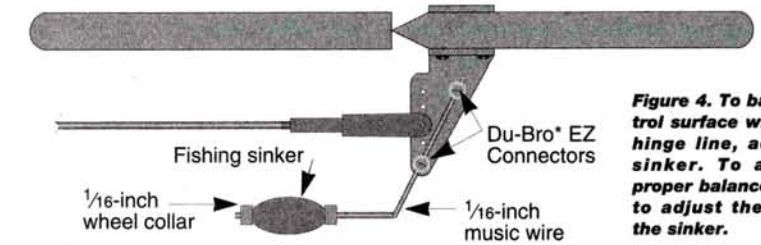
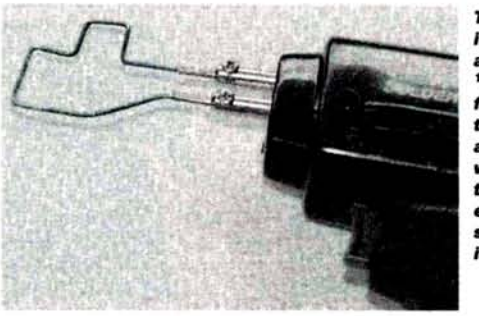


Figure 4. To balance a control surface with a straight hinge line, add a fishing sinker. To achieve the proper balance, you'll have to adjust the location of the sinker.

by MIKE LACHOWSKI

PREPARING AIRFRAMES FOR SERVO INSTALLATION



To hot-wire servo openings, you'll need a wire and a soldering gun. Use 1/16-inch music wire formed to the width of the servo. You might also add an extra bend to provide a depth marker for the cut. Bend the open ends of this wire into the soldering gun—replacing its usual tip.

THIS MONTH'S TOPICS include preparing foam wings for wing-servo mounting and using the servo mount in the fuselage to strengthen the fuselage. Don't forget this month's thermal tip. Let me know if you find these helpful or if you have any other handy tricks to share.

PREPARING WINGS FOR SERVO INSTALLATION

To complete foam wings, often you have to cut a hole for aileron and/or flap servos. Many kits come with these holes already routed, but if yours didn't, mark and cut the skin in the mounting area with a good, sharp knife. A few cuts through the middle of the servo area will make it easier to peel back the skin. Now, remove the foam with a router or a router attachment and a Dremel* Moto-Tool. You can also cut the foam with a hot wire—a method I use because there's less clean-up.

To hot-wire, you'll need a wire and a power source, such as a soldering gun. Use 1/16-inch music wire formed to the width of the servo. You can also add an extra bend to provide a depth marker for the cut. Remove the soldering-gun tip, and fit the open ends of the wire into the gun. Hold the trigger down for a few seconds to warm the cutting tool, and test the tip on some scrap foam. If the gun is too hot, release the trigger, and let the tip cool down a little. With practice, you should be able to control the temperature.

There are plenty of ways to mount servos in wings. Many pilots will push the servo tightly into a hole, so that the servo case is flush with the wing's bottom surface. When using a simple friction fit, apply tape over the wing and servo to keep it in place.

If you are reluctant to work with a 120V gun on white foam, another option is to make a cutting tool out of .020- or .024-gauge stainless-steel fishing leader. For power, attach the wire to two or three D-cell alkaline batteries. This is a simple and cheap method, but make the cut carefully. Otherwise, the thin wire will easily bend, and your cut won't be square.

These tools are also handy for cutting wing-core storage beds. Just use the hot wire to notch the bed at the flap and aileron pushrod locations. You can also cut servo and radio mounts in foam and tape slope soarers.

MOUNTING THE SERVO

How to mount servos in wings is a topic of endless discussion. Many pilots will push the servo into a tight-fitting hole, so that the servo case is flush with the wing's bottom surface. For a simple friction fit, apply tape over the wing and servo to keep it in place. This method works fine for a while, but the servo can loosen over time. Other pilots glue the servos into the wings. Epoxy and silicone work best if you first install a solid base, e.g., a piece of thin plywood, over the foam. You could also make a plug that's in the shape of the servo. Apply epoxy inside the servo well, and insert the plug. Don't forget to apply release coating on the plug. After the epoxy, has cured pop out the plug, and you have a solid mounting area suitable for gluing or friction/tape mounting. (Use small amounts of epoxy with this method.)

One way to help make the servo removable with minimal damage to the wing is to wrap the servo with clear tape. The epoxy sticks well enough to the tape to hold things in place, but the tape will come off the servo before everything is pulled apart. Remember, the idea is to hold the servo firmly in place, not to make it a permanent part of the wing structure.

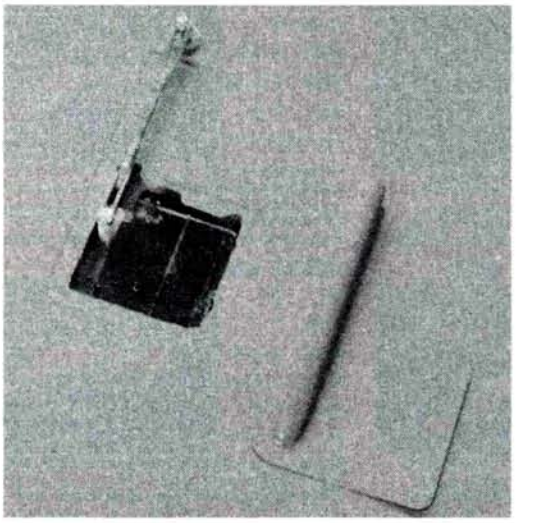
Silicone glue is easier to remove than epoxy. Use dental floss to cut through the glue and remove the servo; it works great in molded wing structures. Again, keep the glue to a minimum because a thick bed of glue under the servo makes the servo flex.

Which method should you use if you have to replace the servo gears? Stay with the friction fit, and consider tying a string or wire around the servo to help in removal. For a solid mount, take the time to build in mounting rails, and attach the servo with screws.

FUSELAGE SERVO TRAYS

Most fiberglass fuselages are strong and durable, but they can bend in front of the wing, especially if there is a large cutout under a canopy or nose cone. Sometimes, the model will bounce and jump during a less-than-perfect touchdown. For spot landings, this bounce can mean the difference between an acceptable landing and a really bad one, because the fuselage is acting as a spring.

Fortunately, a simple modification during construction can get rid of this flex and make your fuselage stronger. Usually, there is a servo tray where the flexing occurs. To create a more rigid structure that resists flexing, lengthen the servo-mounting-tray inside the fuse-



Here's a servo installation in a molded sailplane. No holes had to be cut in the wing, and the linkages are protected by the hatch cover, which sits flush with the wing surface for improved airflow.

lage, and extend it forward and backward behind the canopy/radio opening in the fuselage.

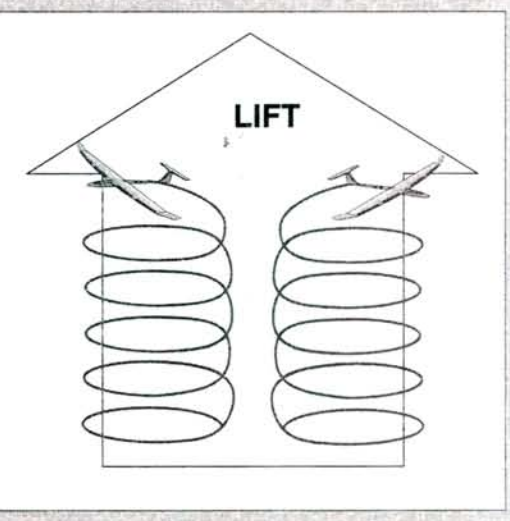
To determine the dimensions of the new tray, make a cardboard template that fits properly in the fuselage (if you make an error and trim too much, cardboard is much cheaper to replace than hardwood). Using the template, cut a piece of 3/32-inch- or 1/8-inch-thick, five-ply plywood. You can also cut openings for your servos. For the best adhesion when you glue the plywood to the fiberglass, rough up the glass surfaces with sandpaper, then clean the inside of the fuselage. For extra durability, use fiberglass on the joint, and overlap the fiberglass on the tray and fuselage. The longer tray attached with this method will really strengthen and stiffen the front of the fuselage. Its larger bonding area won't become unglued as easily as a short servo tray or servo rails.

If you prefer to mount the receiver with Velcro®-brand fastener, the tray provides a perfect place for it. Stick one side of the fastener on the tray and the other on the receiver. The only drawback is that the extended tray can get in the way when you're loading ballast into the fuselage.

I hope this information answers questions you might have. See you next month.

**Addresses are listed alphabetically in the Index of Manufacturers on page 184.*

EFFICIENT CIRCLING



Almost every thermal pilot I have seen prefers to turn in one direction. In fact, many pilots fly the entire flight always turning in the same direction. When you practice, you should try to circle in the direction opposite to the one you prefer.

The ability to turn efficiently in both directions is an important skill that eliminates the need to reposition your model before you enter a thermal. This extra turn can be the difference between flying in the thermal and having to land.

It's also good to turn in the same direction as others when sharing the same thermal; this will minimize midairs if the aircraft are are flying at the same altitude.

Aerobatics MADE EASY

by DAVE PATRICK

THE INVERTED FLAT TURN

I GET a lot of requests to write about unusual maneuvers. There seems to be no limit to the aerial maneuvers we can imagine and, with today's terrific equipment, we are seeing some amazing aerial displays. But you don't always need a high-tech machine to do some interesting flying; in fact, you can get a lot of enjoyment from a good sport plane. And frankly, fun is what it's all about.

With that said, this month, we're going to work on the inverted flat turn—a rather interesting maneuver that's rarely seen. The good news is that it's not all that difficult, and almost any aerobatic sport model can handle it.

THE SETUP

The only basic requirement is that your plane be able to fly inverted fairly easily. A nice feature would be to have very little or no roll coupling, so when you apply rudder input to yaw your aircraft, the plane will not roll or pitch. To be honest, most airplanes have some coupling. The better designs have a minimal amount of coupling, which is accomplished by the incidence angles of the wing and horizontal stab, their placement on the fuselage and the amount of dihedral in the wing. I mention this because when you yaw your plane, you don't want to fight against a resultant pitching or rolling.

A "YAWING PROBLEM"

To check your aircraft for coupling, simply roll it 90 degrees to knife-edge; for example, roll right and apply left rudder to sustain level flight, and observe whether the model wants to roll and/or pitch. (For more discussion on this, see Chapter 2 of my book, "Aerobatics for Everyone.") If you plan to do nothing about it, well, at least you know and can anticipate the errant flight path; however, help is on the way in the form of today's computer radios. Oh, by the way, you should check coupling using both left and right rudder, as the results may be different!

Now let's say that right rudder results in some down-elevator effect. The plane has rolled 90 degrees to the left for knife-edge, and right rudder is applied to sustain the knife-edge. The down-elevator effect will make the plane tuck and actually turn to its right; the bottom of the plane is now the right side of the plane. The fix is simple when you think about it: mix some up-elevator when right rudder is input. Refer to your radio manual to learn how to mix your controls; it's time well spent. By the way, the amount of mix needed is usually small, so start with 5 to 10 percent.

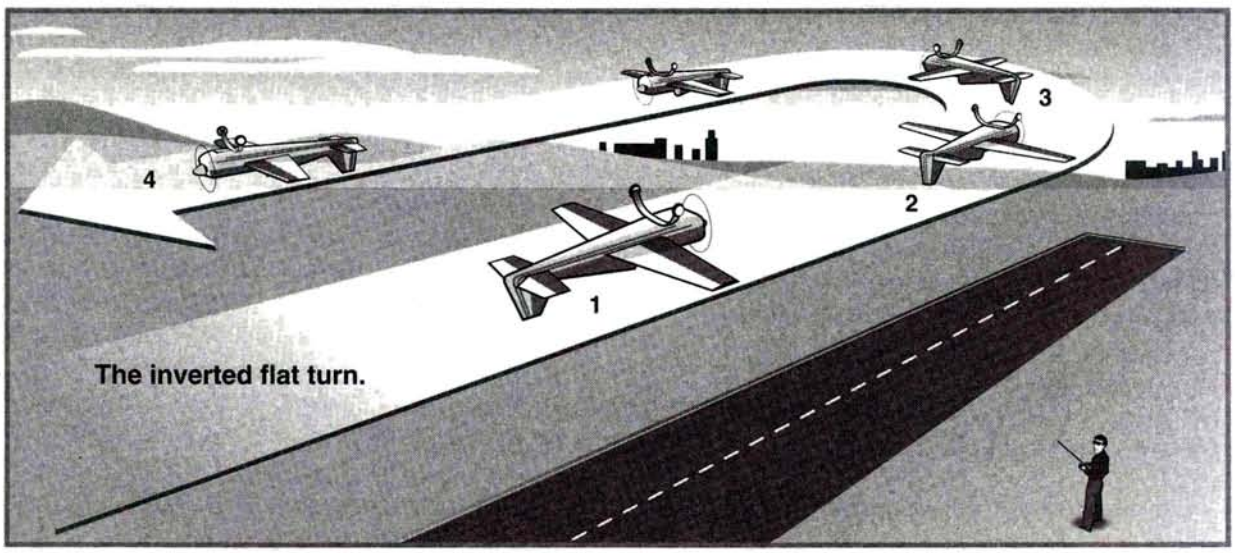
LET'S TRY ONE OUT

OK, now that you're happy with your model, let's describe the maneuver. If you're entering from the left, roll inverted and establish a comfortable inverted flight (1); now, as the plane passes in front of you, apply right rudder (2). (Remember, rudder is reversed when the model is inverted!) The aircraft will fly away in a flat turn (3). The idea here is to complete a 180-degree turn while the wings remain level. It may seem simple, but it's always impressive when it's done well—especially if the altitude is low!

A FEW HINTS

At first, don't hammer in full rudder deflection right away. Use partial rudder so you have some reserve throw to adjust your rate of turn as you go around, especially if there is a breeze. Second, it helps to focus on keeping the wings level and maintaining altitude. Third, learning aerobatics means learning unusual attitudes, and this maneuver does look different, so take your time, start high and work on it until you're comfortable. As different as this maneuver is, pilots seem to learn it fairly quickly.

Well, that's it for this month—another maneuver for your repertoire. Enjoy!



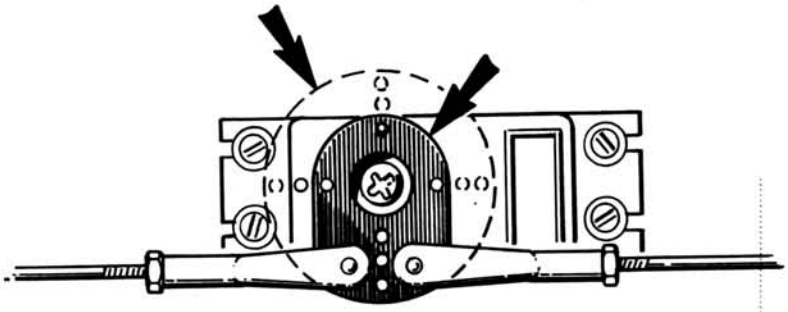
The inverted flat turn.

ILLUSTRATION BY DALE TREECE

Hints & KINKS

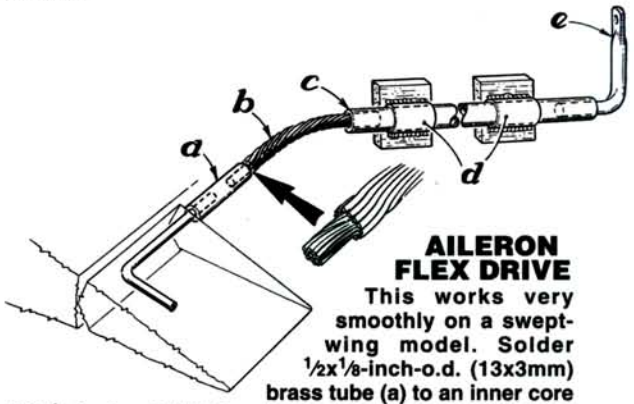
by JIM NEWMAN

Model Airplane News will give a free one-year subscription (or one-year renewal, if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman c/o Model Airplane News, 251 Danbury Rd., Wilton, CT 06897-3035. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.



AILERON DRIVE

Trim and drill a large servo disk as shown, then use it to drive aileron pushrods through threaded pushrods and adjustable clevises. ***Cory Young, Midland, Ontario, Canada***

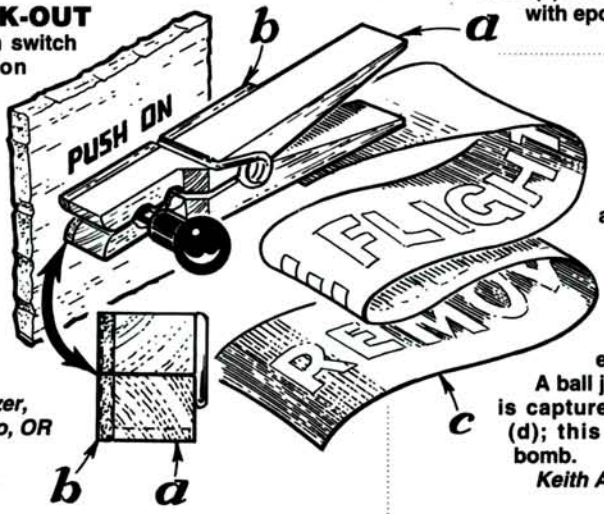


AILERON FLEX DRIVE

This works very smoothly on a swept-wing model. Solder ½x⅛-inch-o.d. (13x3mm) brass tube (a) to an inner core of 2x⅛-inch-o.d. (50x3mm) speedometer cable (b); then epoxy the cable into an aluminum torque tube (c) that runs through aluminum-tube bushings (d). The aileron horn (e) is made of bent aluminum tube that's reinforced with epoxy at the bend. ***Art Quillen, Hobart, IN***

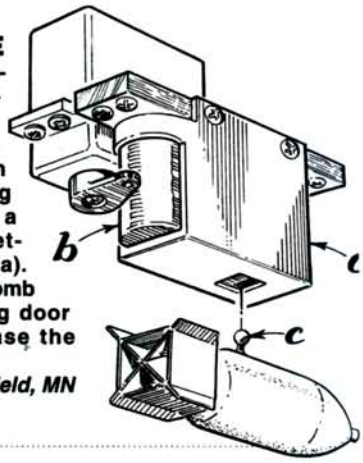
SWITCH LOCK-OUT

To prevent the off/on switch from being turned on inadvertently (and flattening your Ni-Cds), attach a modified clothespin (a) as shown. Balsa shims (b) bury the spring coil to protect the plane's finish, and a red, vinyl "Remove before flight" streamer (c) warns you—just like in full-size planes!
Bob Sweitzer, Hillsboro, OR



SWEET RELEASE

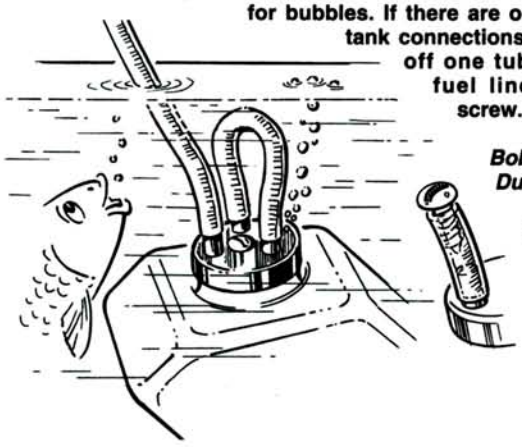
This bomb-release mechanism works by having a servo arm press on the operating button (b) of a modified sweetener dispenser (a). A ball joint (c) on the bomb is captured by the sliding door (d); this opens to release the bomb.
Keith Anderson, Northfield, MN

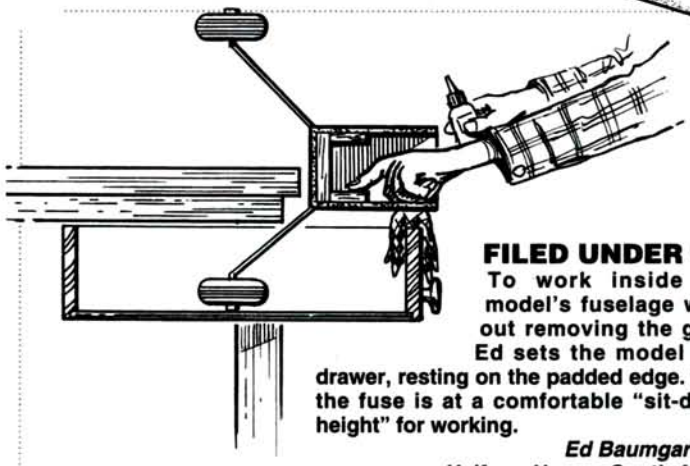


TANK TEST

Check for leaks by pressure-testing the tank under water before you install it. Join two brass tubes with fuel line, then blow into the third tube and watch for bubbles. If there are only two tank connections, close off one tube with fuel line and a screw.

Bob Robert, Durrington, Wilts., England





FILED UNDER "F"

To work inside his model's fuselage without removing the gear, Ed sets the model in a drawer, resting on the padded edge. Now the fuse is at a comfortable "sit-down height" for working.

Ed Baumgartner, Halfway House, South Africa

Sport-scale 2-place aerobatic trainer

MODEL AIRPLANE NEWS
CONSTRUCTION

by MARK SIRIANNI

Sukhoi Su-29

I HAD designed a 1/4-scale model of the Su-26, so the decision to build the new Su-29 was not difficult to make. After receiving 3-view drawings and technical information from Bob Banka at Scale Model Research*, I started my new project.

I decided on an 80-inch-span model that would be IMAA-legal and light enough to fly with my trusty SuperTigre* .90. I knew my .90 would easily pull a 10-pound model, so that was my target weight (minus fuel, the finished weight was 10 pounds, 4 ounces). When I had finished all of the designing, I started the construction process with the wing.

CONSTRUCTION

• **Wing.** Pick a piece of hard, 1/8-inch balsa and make the leading-edge (LE) jig. The jig tapers from 1 3/4 inches to 3/4 inch, with the thicker end under the wing center and the thinner end under rib 12. Pin the 3/32x4-inch trailing-edge (TE) sheeting over the plans. Glue the bottom 1/8x1/4-inch spar into place on top of the TE sheeting. Pin all the ribs to the jig and to the bottom spar. Make sure the ribs are flat on the TE sheeting. When you're satisfied with the fit, CA the ribs to the bottom spar and the TE sheeting.

Three generations help to make this flight a success. I check the engine while my Dad and son, Tom, hold the plane.

Add the top 3/8-inch-square spruce spar. Add the top 1/8x1/4-inch TE spar. Glue the 1/4-inch thick plywood aileron-control-horn plate between ribs 5 and 6. Sand the tops of the ribs flush with the top spar, and add the balsa filler block at rib 1. Glue on the top LE sheeting. Add the 1/2-inch leading edge. Add the 3/32x4-inch-wide LE sheeting. Do not sheet the landing-gear area at this time; this will be done after the gear has been installed.

Keep the wing pinned to the jig until the glue has dried completely; then turn it over and glue the bottom 3/8-inch-square spruce spar into place. Do not add the bottom TE sheeting yet. Build the left wing panel up to this point.

The wing panels are joined upside-down on a flat work surface. Cut an 1/8-inch slot at the rear edge of the spar and rib 1. This will allow the dihedral brace to slide through. Lay some wax paper over the center of your plans, and pin the panels over the wing top view. Keep the top spar flat on the work surface. Epoxy the dihedral brace securely to the backs of the main spars, and let the epoxy cure completely. Epoxy the 1/8-inch-plywood ribs (1A) into place. They should be flush with the top of wing rib 1. This rib sets the proper angle for the landing-gear plate.

Here's the Su-29 (right) with its counterpart, the Su-26. Both are great flying models and will provide hours of aerobatic fun.

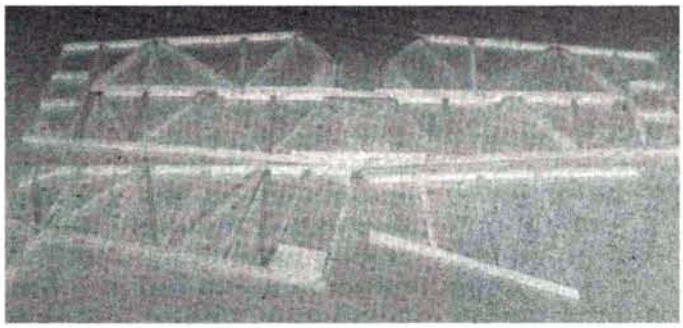
Epoxy the landing-gear plate into position. This is a very important part of the wing because all the stress of the landing gear will be on this plate. Drill two 3/8-inch-diameter holes in the front dowel plate, and then epoxy the plate into place. Do not install dowels yet. Add the bottom 3/32-inch-thick LE sheeting.

Install the landing gear with 6/32-inch screws and blind nuts. Use epoxy around the blind nuts to make sure they do not come loose. Sheet the top center section of the wing, but don't sheet the bottom until later. Install the 3/32-inch-thick vertical-grain shear webs and the tubes for the aileron wires. The ailerons were cut out of the completed wing, finished with a leading edge, then hinged into place. Install the aileron servo rails and the servos. Sand the wing and then set it aside until later.

• **Tail surfaces.** These are constructed over the plans. Each is a 1/4-inch-square balsa framework sheeted on both sides with 1/16-inch-thick balsa (I used 6-inch-wide Sig* balsa sheet). Make sure you have the lite-ply control-horn bases on both elevator halves. Let the glue dry; then sand the tail surfaces to shape and set aside.

• **Fuselage.** This is built in top and bottom halves over the 1/4-inch-square balsa crutch. The 1/4-inch-square crutch is pinned over the top view of the plans; the top-half formers are then glued to it. Add the 1/4-inch-square spruce crutch doubler. Glue two Fl formers together; glue F2 to the back of Fl.

Use your engine as a guide to determine how far back to position F3. The plans show the approximate position for a 1.20 4-stroke. Mount the aluminum engine mount on F3 and F3B. Carefully draw a centerline on each of these, and attach the mount using 8-32 screws and blind nuts. Glue F3 into place; then add F4, F5 and F6. Build your tank compartment to suit your tank. Glue the remaining top formers into place. Carefully check the rearward slant of F9. Add the 1/8-inch balsa cockpit floor and instrument panels 1 and 2. Glue in the top turtle deck 1/4-inch-square balsa and 1/4-inch-square spruce stringers. The middle 1/4-inch-square spruce stringer should be parallel to your work surface. This is the base on which the stab sits, so it must be level. Add the 1/4-inch balsa filler under the stab and let the top half of the fuselage dry. When it's dry, sheet the entire top with soft 3/32-inch balsa. Keep the framework securely pinned to the work surface, and use aliphatic resin glue so that you'll have plenty of time to get things pinned into place. Sand the tops of F9, F10 and F11 after the glue has dried. Add the 1/2-inch-thick-balsa top. Cut it a little oversize to allow for shaping. When the top is dry, unpin the top portion of the fuse and turn it over in preparation for building the bottom.

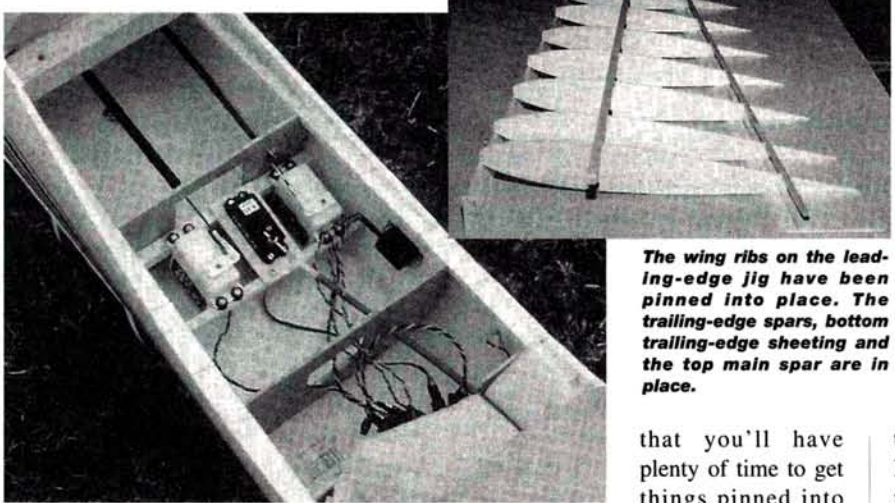


The completed tail framework. This type of construction helps to prevent the model from being tail-heavy.

Glue two F1B formers together, and glue F2B to the back of them. Glue F3B into place. Check its fit by attaching your engine mount to F3 and F3B. Epoxy F3B, F4B and F5B into place, making sure they are straight. Add the bottom 1/4-inch-square balsa stringer. Epoxy the 1/8-inch aircraft-grade plywood dowel doubler to the back of F5B.

Place the fuselage upside-down in a Robart* stand, and level the fuse with the work surface. If you have an incidence meter, the next steps will be much easier. Put the wing into place on the fuselage. To mark the dowel locations on F5B, I used a 1/4-inch doweling center—a metal plug that has a sharp point on one end. The plug fits into the holes in the front dowel plate. Simply set the wing in the wing saddle area at zero incidence and press it forward. The doweling centers will put small marks on F5B at the exact places where the holes should be drilled. Also, carefully measure the distance from each wingtip to the tail post; make sure both distances are equal.

When you are satisfied that everything is aligned, drill the holes in F5B. Remove the wing from the fuselage and, using a long drill bit, drill two holes for the rear dowels in the 1/8-inch plywood



In this fuselage, there's plenty of room for any radio. Here's my setup.

The wing ribs on the leading-edge jig have been pinned into place. The trailing-edge spars, bottom trailing-edge sheeting and the top main spar are in place.

SPECIFICATIONS

Scale: 1/4-scale aerobatic monoplane

Wingspan: 80 in.

Length: 54 3/4 in. (including spinner)

Wing area: 1,036 sq. in.

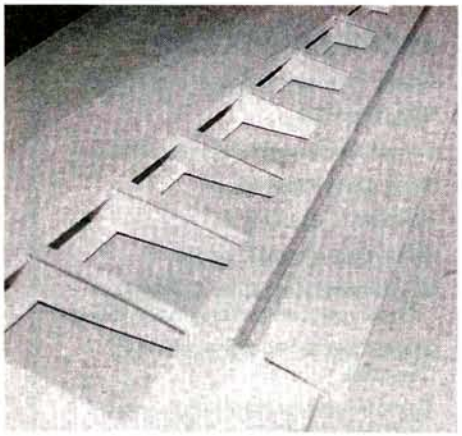
Weight: 10 lb., 4 oz.

Wing loading: 22.80 oz./sq. ft.

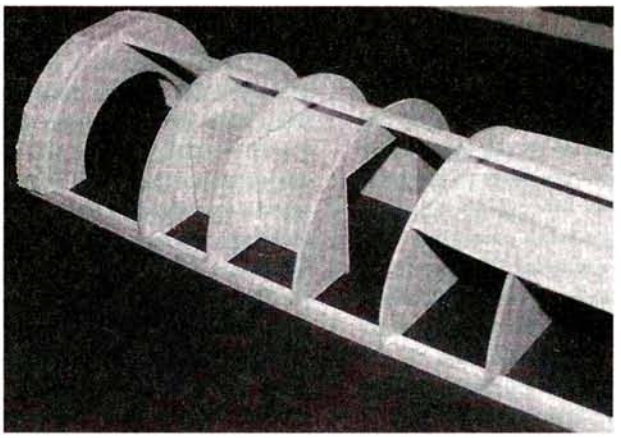
No. of channels req'd: 4 (elevator, rudder, aileron, throttle) and 5 servos

Engine req'd: .90 2-stroke or 1.20 4-stroke

Comments: this IMAA-legal, sport-aerobatic model is easy to fly.



When a wing panel is complete, the ailerons are cut free; the trailing-edge cap and the aileron cap are in place.



The forward top section of the fuselage showing the framework and the tank compartment.

dihedral brace. Epoxy the dowels into place, and finish sheeting both sides of the wing. Epoxy the 1x6-inch hardwood wing hold-down block into place. Try the wing on the fuselage and check its fit. Measure wingtip to wingtip, and when you're satisfied with the measurement, drill holes through the wing and into the hardwood block. Drill and tap for a ¼-inch nylon bolt.

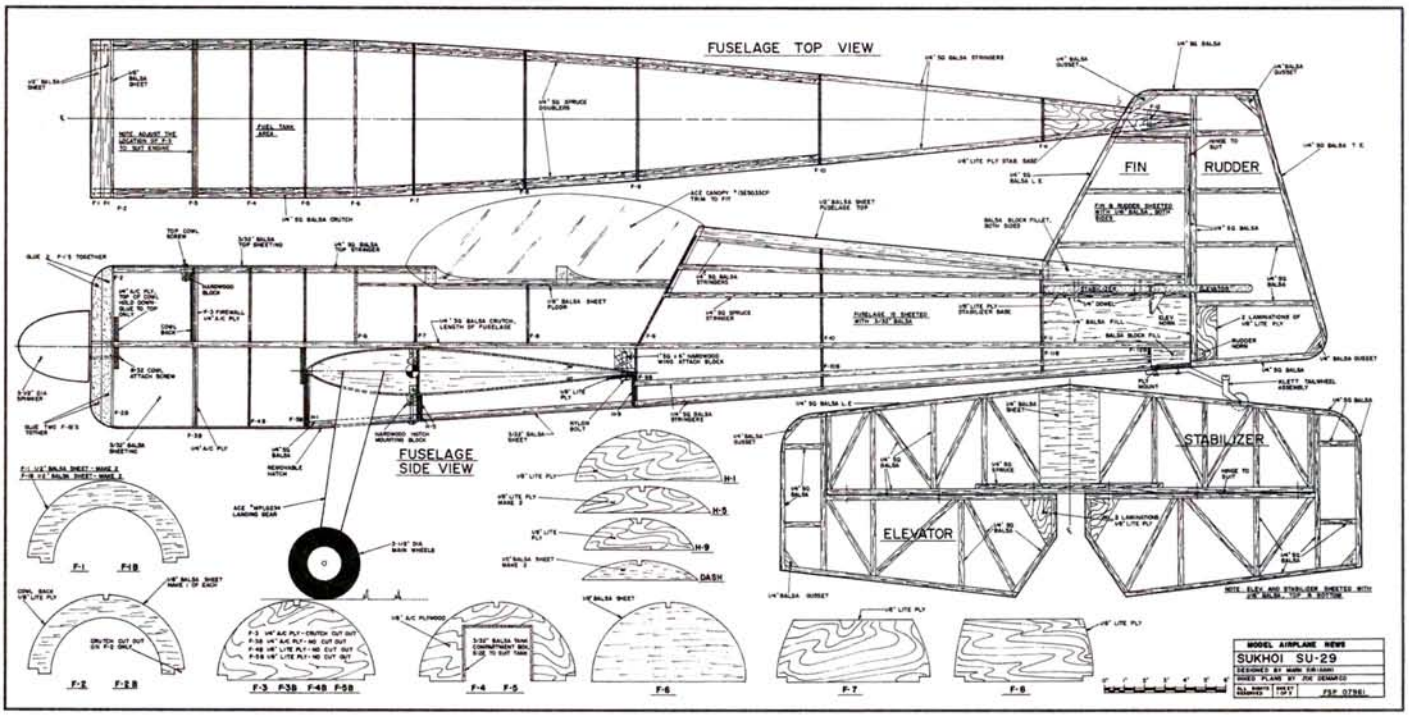
Sheet the front bottom of the fuselage. Add the rear bottom formers and the ¼-inch-square balsa stringers. Plan your pushrod installation and then sheet the fuselage bottom with soft balsa. Test fit and level the stab on top of the ¼-inch-square spruce stringers. Add the plywood stab base between the stringers. I usually use a screw to attach the stab to its base. Drill ¼-inch holes through the plywood base and the stab for the fin dowels. Add soft balsa blocks to the side of the fin and sand it to shape.

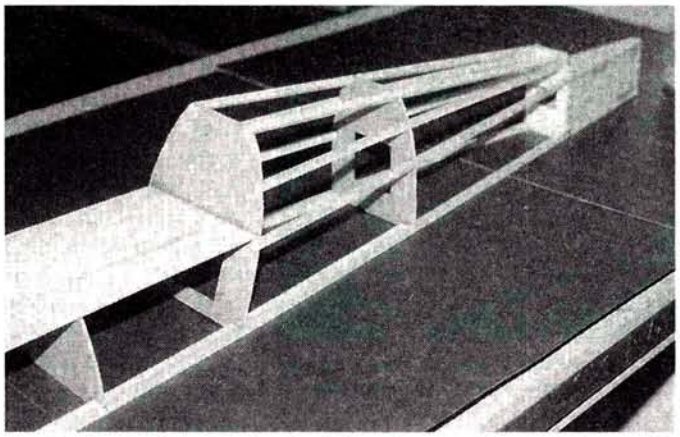
The Sukhoi glides well and is quite easy to land. One of my landings was dead-stick, and it was easy to accomplish.

With the wing firmly attached to the fuselage, it's time to build the belly pan and the removable hatch. Set formers H8 and H5 into place. Glue rear H6 and H8 to the wing. Add the ¼-inch-square stringers between H5 and H8. Cut the stringers between the two H6 formers and remove the forward portion of the fuse. This is the removable section that will cover the landing gear. Sheet the belly pan and removable hatch with 3/32-inch-thick balsa. The hatch is attached to the wing with an 8-32 screw. Glue a hardwood block to the bottom of the wing and tap it for this screw. Make sure the hatch is a tight fit.

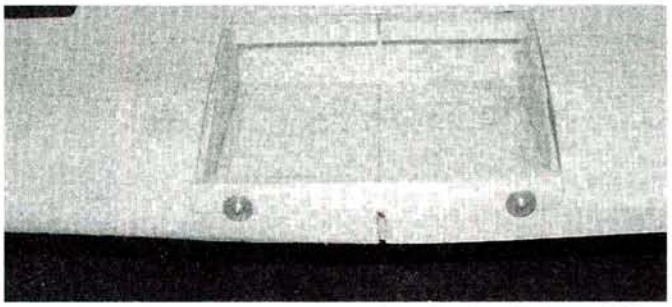
• **Cowl.** After the fuselage has been final-sanded, it is time to cut the top half of the cowl loose. Draw a line in front of F3 and cut along it with a saw. Cut above the crutch and remove the cowl top. Epoxy the two front ¼-inch plywood hold-down plates to the top cowl. Glue the hardwood block to F3. When everything is dry, drill holes for the front and top screws.

With the top cowl half removed, you have complete access to the throttle pushrod, the fuel lines and the engine (to make adjustments). There is no fiberglass to paint, and when you remove the cowl, you don't need to remove the prop and spinner. Cut holes in the bottom of the cowl for the exhaust pipes. Make the holes large enough to help with engine cooling.





The fuselage's aft top section, including the rear stringers and the cockpit floor.



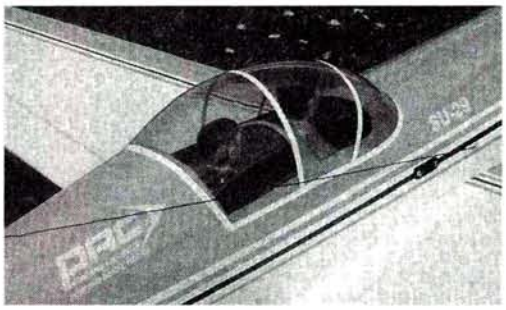
Dowel-centering marks are used to position the dowel holes on F5B.

• **Finishing.** Fill any nicks and dents with a balsa filler, and sand the entire model. I covered the plane with Carl Goldberg's* Ultracote. The covering is easy to work with and goes around curves well. Ultracote can be applied over itself with very few bubbles. I cut all the stripes, stars and numbers out of it. To seal the inside of the cowl, I used black Rustoleum.

• **Canopy.** I used an Ace* Extra 230 1/3 size canopy and two William's Bros.* pilots. Instruments on the rear panel add a little extra touch.

• **Radio and engine.** I used my reliable SuperTigre .90 2-stroke engine with a Master Airscrew* 14x6 prop, a J'Tec* Pitts-style muffler and an aluminum engine mount. A C.B. Tatone* 3 1/2-inch spinner and a 20-ounce Du-Bro* tank finish things off. I used my Ace R/C Micro Pro 8000 transmitter, Pro 810 receiver and five atlas servos.

Before you test your new model, take an evening to go over every control linkage, engine bolt, etc. Cycle your batteries and make sure you have taken care of the smallest detail. Balance the plane properly and make sure the control surfaces are all at neutral. A few extra minutes at home could make the difference between a successful first flight and a real disappointment.

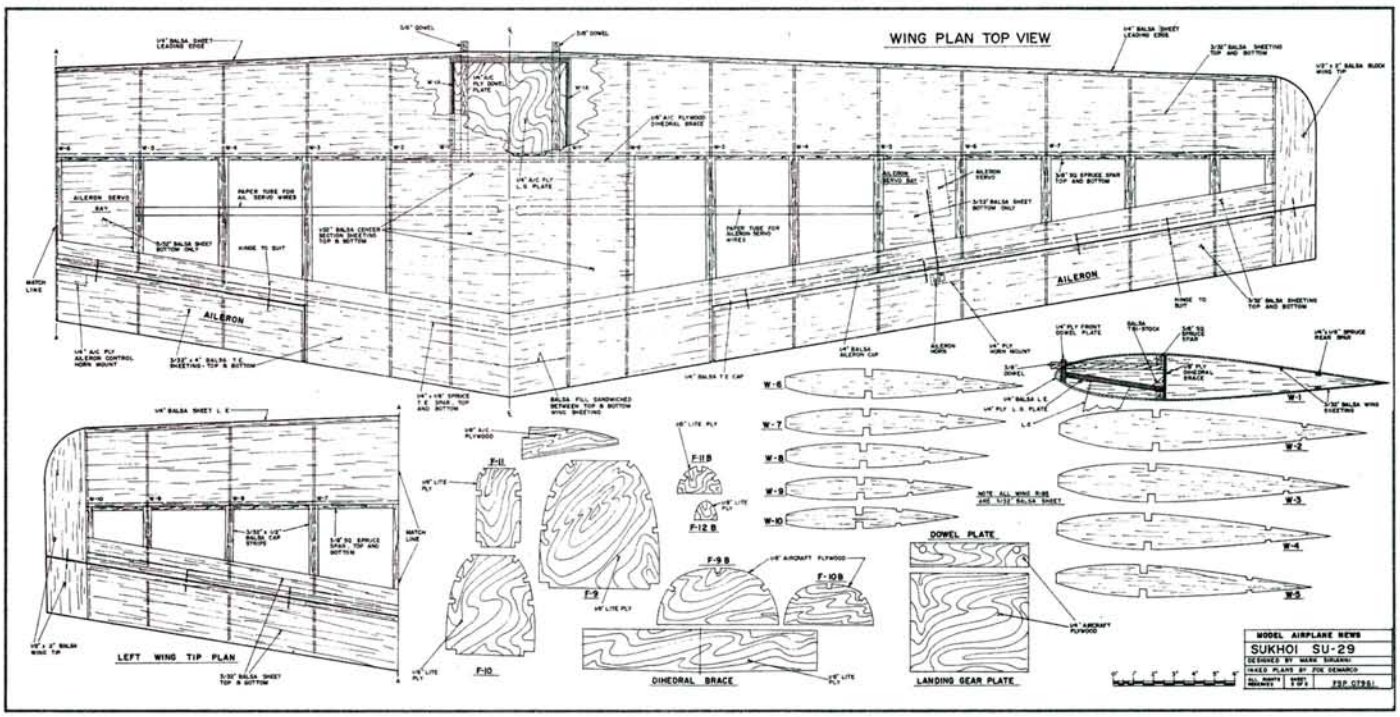


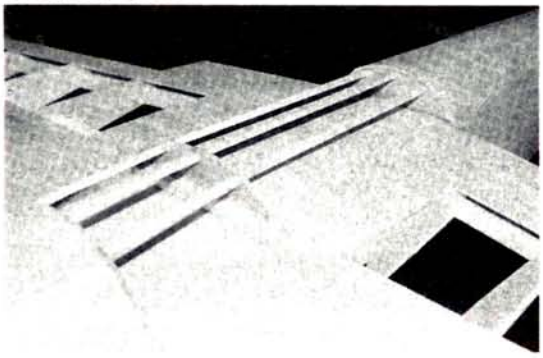
The two Williams Bros. pilots prepare for an aerobatic flight. To dress up the cockpit a little, I added two instrument panels.

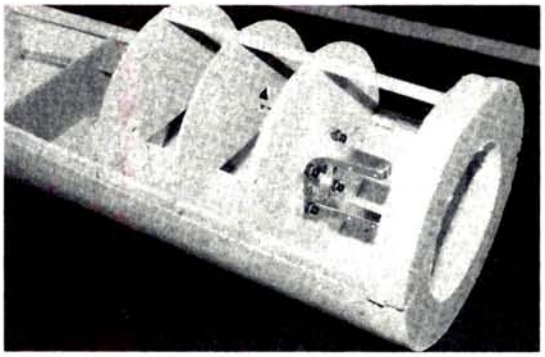
• **Flying.** The model weighed 10 pounds, 4 ounces, and I was a little nervous about the SuperTigre .90's ability to pull this weight around. When the weather cleared up, we headed to the field and took a few more pictures. I started with a few high-speed taxi runs to check the plane's ground handling. The Su-29 tracked perfectly straight and seemed to accelerate very quickly.

We refilled the tank and the moment had arrived. The Su-29 lifted off easily using about half of the field. The .90 pulled the model around with authority, and the plane was rock solid; I never touched the trim levers. After it had

TO ORDER THE FULL-SIZE PLANS, SEE PILOTS' MART.







Left: the constructed belly pan and removable hatch before sheeting has been added to their framework. Right: the bottom formers are in place. The holes have been drilled in F5B, and the engine mount has been attached to F3 and F3B.

gained some altitude and I had calmed down a bit. I put the Sukhoi through a series of loops, rolls and Immelmanns—all very precise. The rolls were smooth, and the loops were done easily from level flight.

The model does not have the vertical performance that it would have with a larger engine, but for me, the .90 did a great job After 8 to 9 minutes—about 300 feet high and downwind—the engine quit. I just kicked in some down-trim and easily made it back to the field for a beautiful landing. The model never dropped a wing or seemed to want to stall. Later flights proved to be a joy; this model will do anything that you ask of it—loops, rolls, spins, etc.

The completed fuselage is ready to cover.

DESIGNER'S DREAM

This big, impressive Su-29 is the best flying model I've ever flown, and it gets noticed at the flying field. Its performance is everything I had hoped for—no bad habits and a real delight to fly.

With a larger engine, such as a YS* 1.20 4-stroke or a Webra* 1.20 2-stroke, this model would be awesome.

This is my fifth published design, and it was by far the most enjoyable to work on. If you want to move up to IMAA, this Su-29 will make you look good. If any builders have questions, I'll be happy to help. Please contact me: (814) 837-9435.

Enjoy!

**Addresses are listed alphabetically in the Index of Manufacturers on page 184.*

About the author

A watchmaker and jeweler by trade, Mark Sirianni lives in Kane, PA, with his wife and three children. He has been building and flying model airplanes with his Dad, Joe, for more than 25 years. In his spare time, he custom-builds his own designs and other kit models at Mark's Model Building, which now offers a laser-cut semi-kit of the Su-29.

by MIKE LEE

6th Annual

Best in the West Jet Rally

IT'S FITTING that the sixth annual Best in the West Jet Rally was held in Lancaster, CA, last February; Lancaster is a center for jet-aircraft research and development, and it's near Edwards Air Force Base.

The weekend of low-key competition and hot action for scale and sport aircraft was hosted by the Antelope Valley Tailwinds Club (AVTI) and CD'd by Dave Eichstedt. More than 65 pilots were registered to fly off the

Rich Fong won the Technical Achievement Award with this outstanding P-80. Working air brakes; flaps; sequencing gear doors; detachable tip tanks.

It took Aki Yamanouchi (Torrance, CA) eight months to build this F-18. Pilot—Al Coleman (Anza, CA); Yellow Aircraft* kit; twin O.S.* 91s; Ramtec* fans; Yellow Aircraft retracts; air brakes; canopy lift; flaps; sequencing doors; 34 lb.

John Redman's gorgeous F-16 captured three awards. He equipped his model with working speed brakes, ground brakes, a pop-up canopy, sequencing gear doors and superb detailing. John is a U.S. Air Force F-117 crew chief.

Bob Violett's T-250 turbine-powered T-33 comes in for an effortless landing. Being two steps ahead of your model is a must for flying turbine-powered models.

600x45-foot concrete runway, and more than 80 aircraft were in the pits, waiting their chance to turn and burn.

THE NEED FOR SPEED!

As the day progressed, the wind grew stronger, and many scale ships were wisely put away to fly another day. The sport ships, however, relished the winds, as the fastest jet competition got under way. Imagine taking your model almost out of sight above your head, rolling over and dropping the nose straight down at full power. Your target is a 200-foot-long speed trap just off the far edge of the runway, and you must pass through it at no higher than 20 feet! Larry Jacobs showed the way for the fast crowd. He consistently broke 220mph; one pass was clocked at 240.3mph—holy cow!

Because the rules require two passes within 5mph of the pilot's fastest time, Larry was only able to capture a 238.5mph time, while Chris Huhn topped out at 244.4mph, but only once. Chris had to settle for a backup speed of 238.5—the same as Larry's. Both flew BVM* Vipers or Mavericks. Larry's ship was equipped with a variable-thrust tail cone, which, he said, increased high-speed thrust. Bob Violett jumped into the fray, posting a 230mph+ run. By the time the speed runs were over, the high winds had stopped the flying for Saturday.

Gary Hanafin (San Diego, CA) poses with a slick F-4 Phantom, made from a George Miller Kit*. Rossi* .90 on a Byron* fan; Deltron paint finish; 12.5 lb.

PHOTOS BY MIKE LEE

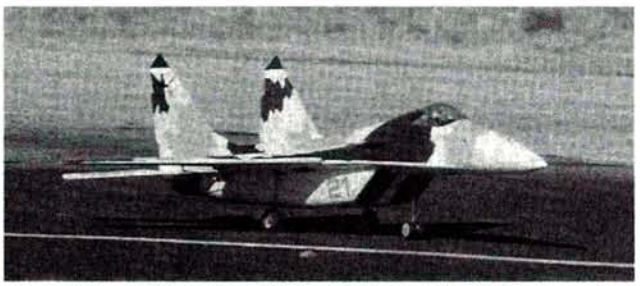
Imagine taking your model almost out of sight above your head, rolling over and dropping the nose straight down at full power. Your target is a 200-foot-long speed trap just off the far edge of the runway, and you must pass through it at no higher than 20 feet! Larry Jacobs showed the way for the fast crowd. He consistently broke 220mph; one pass was clocked at 240.3mph—holy cow!

THE TURBINE IS HERE

Bob Violett set the pace on both days with an awesome display of technology. His BVM T-33 was equipped with a fire-breathing JPX T-250 propane-fueled turbine engine. Bob's museum-scale T-33 featured air brakes, ground brakes, flaps, full cockpit details—the works! At 23 pounds, this model was perfectly matched to the turbine.

Larry Wolf says that 7.5 fan power is alive and well, especially with this fine example of a Jet Hangar Hobbies* F-86 Sabre. Turbax* fan with K&B* 7.5; 11 lbs.

The sound made by this model was no different from a manned jet aircraft. Indeed, the only difference is the size. Once Bob released the brakes at full thrust, all you could hear was the whine and whoosh of a real jet turbine. The crowd was hushed and in total awe as Bob toured the skies. There was no apparent lack of power in the ship as it executed vertical maneuvers with ease. Bob topped off each flight with a gorgeous landing that made the Tweety bird look much lighter than 23 pounds.

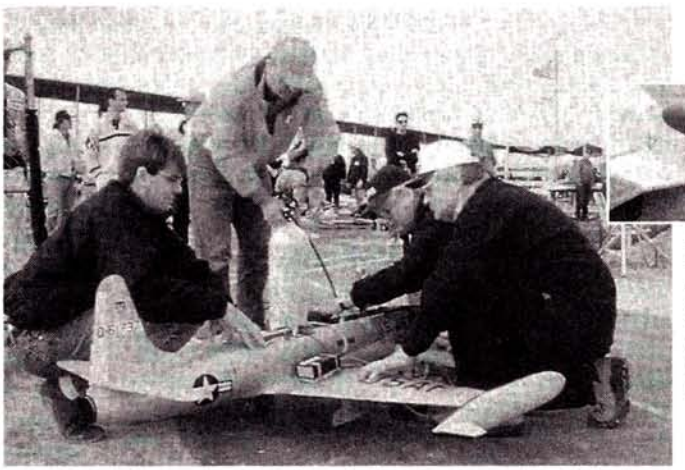


Dean Richards' (Arcadia, CA) Top Gun model MiG-29. Byron fan, O.S. 91; Top Gun pipe; Spring Air retracts; 14 lb.*

John Boudreau built this T-2 Buckeye using a Target Aviation kit. O.S. .91; Ramtec fan—70-inch span; Spring Air retracts; 13 lb.*

Jerry Ortego (Cerritos, CA) built this F-14 swing-wing model as a prototype for DCU models. Twin engine model; Dynamax* fans; O.S. 91 engines; DCU retracts; 21 lb.*

Chris Huhn was all smiles after hitting 244.3mph with this BVM Viper. He won the overall flying competition with this aircraft.



Bob and ground crew work on the T-33 before another flight.

Dean Richards mounted this video camera in the canopy of his F-15, which won him the Best McDonnell Douglas Award.

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Tim Hayes
Tower Hobbies
Windsor Propeller Co.
Zone 5 Aircraft

AWARD	PILOT	AIRPLANE
Best Twin Engine Jet	**Harry Woods**	Cessna Citation
Best Scale Flight	**John Redman**	F-16
Technical Achievement Award (sponsored by NASA)	**Rich Fong**	P-80
Best McDonnell Douglas Jet	**Dean Richards**	F-15
Best Lockheed Jet	**John Redman**	F-16
Fastest Aircraft	**Paul Ivie/Larry Jacobs**	BVM Viper
People's Choice – Sport Jet	**Paul Ivie**	BVM Maverick
People's Choice – Best Military Jet	**John Redman**	F-16
Most Sorties Flown	**Bob Sumonski**	U-2
Slowest Flight Speed	**Gilbert Ruiz**	Midwest Jetster 20

Overall Winners—
Flight Competition

1—Chris Huhn
2—Bob Violett
3—Dale Hess

THE FAST AND THE SLOW

The slowest flight was performed by Gilbert Ruiz of Mesa, AZ. He took an old Midwest* Jetster 20 into the wind and just about hovered the aircraft through the traps. His official speed was actually too slow to clock; it took longer than a minute for a mere 200 feet.

Topping the sport competition was Chris Huhn with a BVM Maverick Pro powered by a BVM .91 engine and a Viojett fan. Right behind Chris was Bob Violett, and he flew the same aircraft as Chris. Dale Hess took third. The fastest speed run at the meet was handled by Larry Jacobs who flew a BVM Viper using a PJP variable-size nozzle and a Nelson* .91R engine. His average run of 240.3mph withstood an assault by many pilots, but none topped the speed demon.

Overall, the Best in the West was quite a success. It featured great aircraft, terrific airmanship and awesome entertainment. Congratulations to the award-winning pilots and to the AVTI club for a fine show. If you want to attend next year's event, contact: George Allison, 9914 Eugenia Ave., Fontana, CA 92335; (909) 829-1807. You'll be glad you went!

**Addresses are listed alphabetically in the Index of Manufacturers on page 184.*

About the author

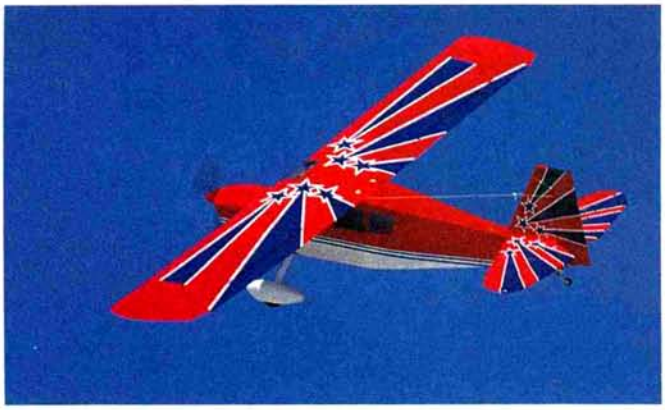
Mike Lee has been writing for Model Airplane News since 1980, and he has built many models for Field & Bench reviews. Mike started flying R/C in 1961, and he prefers pattern, pylon and sailplanes. He is an FAI/Masters pattern pilot.

MODEL AIRPLANE NEWS

FIELD & BENCH REVIEW

by MIKE DEHOYOS

IMAA-legal scale aerobat



Climbing out to the maneuvering area, the Midwest Citabria flies beautifully and looks just as good!

MIDWEST PRODUCTS CITABRIA

THIS new kit is a winner. Now, with their IMAA-legal Citabria, Midwest Products Co. Inc.* have outdone themselves. I obtained it as soon as I could, and 80 hours later, it was finished.

When I opened the box for the first time, I was amazed by the packaging. All the balsa and plywood parts were in their own plastic bags, neatly placed in the box. The instruction manual comes with a set of revisions that I suggest you go over before you start building. As always, parts identification was first; and as I was going over the manual and the plans, I found that there wasn't any way to access the wing servos. I modified this during the construction, and I built the entire plane with Balsa USA* thick and thin CA and 30-minute epoxy.

CONSTRUCTION

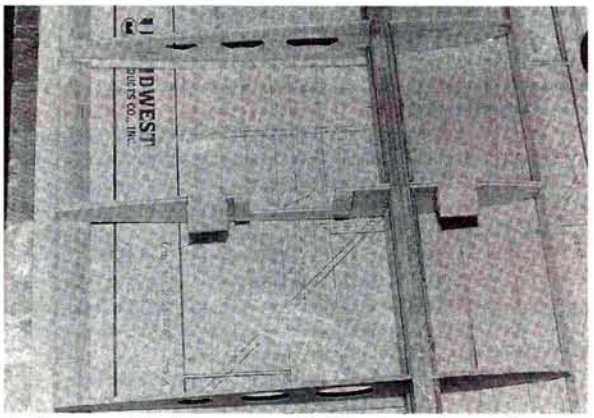
• **Tail surfaces.** The fin and the stab have sheeted, built-up, stick-balsa frameworks. Using 5/16-inch-square balsa and the provided die-cut parts, I built the rudder and elevator, sanded them and set them aside. (I built the entire tail with thick CA.)

• **Wing.** Follow the instructions and make sure that every part is properly aligned. Some of the later steps in the wing construction tell you to repeat some of the earlier steps, and some of the numbered steps that had to be referred back to had been given the wrong number. A quick look at the pictures will dispel any confusion. To ensure that the ribs were at a 90-degree angle, I used a square. For the dihedral braces, I used 30-minute epoxy, and I also glued the W-3 rib with epoxy.

The kit includes a dihedral jig that's used to support the end of the wing panel you just built. Using thin CA, I tack-glued

Coverite's 21st Century fabric and paints were used to re-create the full-scale color scheme. This was my first experience with these materials; they were easy to use, and the paints matched the fabric perfectly.

this jig to the place indicated on the completed panel, and I supported the center of the wing panel with scrap balsa. The second panel is built in just the same way as the first, and then the remaining sheeting and all the capstrips, except the aileron-servo capstrips, are applied. I glued the W-6 servo-reinforcing strips into place and then sanded the bottom.



A close-up of the aileron-servo rib. The plywood mounting supports for the servo screws have been added, and the square, plywood strut-mounting plates are in position.

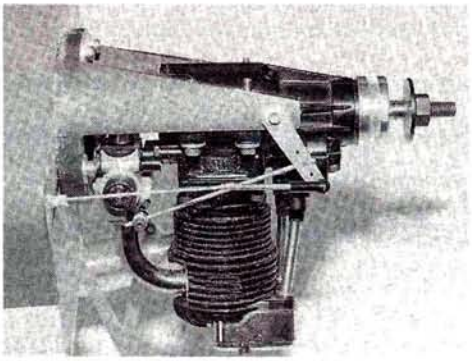
At this point, I made a modification: to be able to access the aileron servos, I made hatches out of the servo capstrips.

To finish the wing, I glued the wingtip parts and the central facing piece into place and then final-sanded the entire wing.

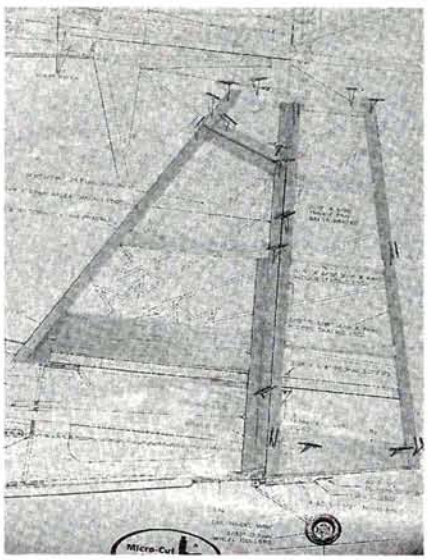
• **Fuselage.** Nothing too difficult here; *before* you glue the parts together, just make sure that everything is straight and that there's no twist to the fuselage. It helps to draw centerlines on all the formers, and it helps to have an extra set of hands to hold the structure. My son, Mike Jr., lent a helping hand.

Before you install former F8, check its rearward placement with the middle side windows in place. If you don't position this former properly, you might have to trim off too much of the windows' rear-edge lip, which is glued to the inside of the cabin area. When it comes to the part where you need to score the fuse sides and bottom, be careful not to cut all the way through. The firewall is glued into place with epoxy, and I added an extra piece of triangular stock to the bottom attachment point.

I gave the landing gear and tailwheel blocks a little extra epoxy and finished the rest of the fuse according to the instructions. One of the last steps was fuel-proofing the tank compartment, and this was followed by the installation of the remaining stringers. I finished the fuselage by installing the wing and tail feathers according to the instructions.

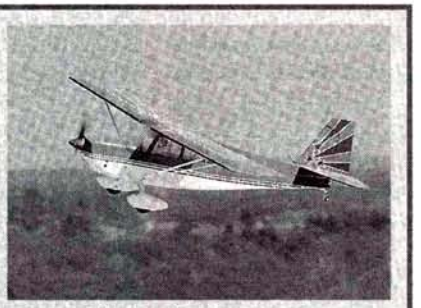


I mounted the Saito Golden Knight .91 on a 45-degree angle. This allowed me to keep the muffler completely enclosed in the cowl, and it also allowed me to cut only the holes needed for the valve covers to protrude.



The framed-up vertical fin and rudder. The entire assembly was built using thick CA.

• **Engine.** For this project, I used a Saito* .91 Golden Knight, which supplied more than enough power. To minimize how much I'd have to cut into the cowl, I installed the engine at a 45-degree angle; to facilitate the installation of the throttle cable, I used the Du-Bro* 4-stroke linkage and a McDaniel* remote glow plug (mounted on the side of the cowl). A Master Airscrew* 14x6 propeller and a Tru-Turn* 2½-inch spinner finish the front of the plane. The weight of the spinner was necessary for balance; without it, you'll find that you have to add weight to the nose and move the battery pack all the way forward.



SPECIFICATIONS

Model name: Citabria

Manufacturer: Midwest Model Products Co. Inc

Type: 20-percent-scale aerobatic

Wingspan: 80¾ in.

Length: 54¾ in.

Wing area: 970 sq. in.

Wing loading: 20.50 oz./sq. ft.

Airfoil: semisymmetrical

Weight: 8 lb., 10 oz.

No. channels req'd: 4

Radio used: Futaba FP-7UAPS with 5 servos

Engine req'd: .60 to .75 2-stroke or .65 to .91 4-stroke

Engine used: Saito .91 Golden Knight

Prop used: Master Airscrew 14x6

List price: $259.95 (kit no. 183)

Features: semisymmetrical-airfoil wing; all-wood, jig-lock construction; pre-molded cowl and wheel pants; pre-formed and pre-drilled landing gear with axles; high-quality hardware; snap-in, pre-formed side windows and windshield; decorative wing struts; an illustrated manual and full-size plans.

Comments: the quality of this kit is exceptional, and it isn't very difficult to build; you'll just need a larger building area than you would use for a sport model of average size. I had a chance to fly it during the test flights, and it was as easy to fly as my large Telemaster.

Hits
- High-quality wood and hardware.
- ABS cowl and wheel pants.
- Great flight characteristics.
- Scale-like appearance.
- IMAA legal.

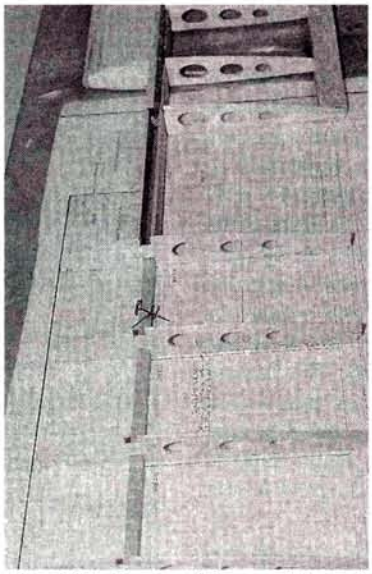
Misses
- No access to aileron servos.

Breaking in the Saito .91 was extremely easy; a few tanks of fuel were run through it—on the rich side—and it was ready.

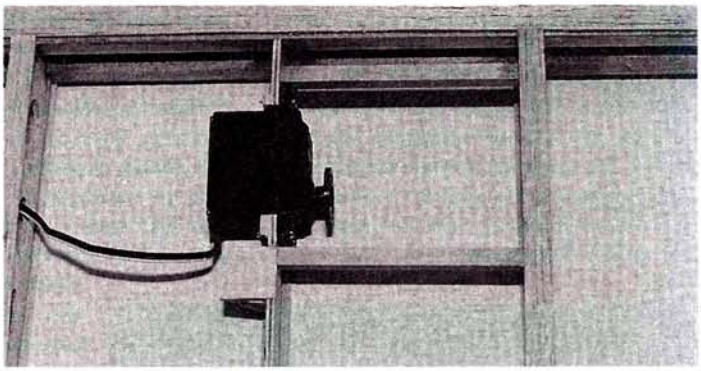
• **Radio.** I installed a Futaba* FP 7UAPS

radio as the manual suggested, but I placed the battery pack right over the landing-gear block. I used arrow-shaft pushrods for the elevator and rudder.

The wing has separate servos for each aileron, and to connect the servos to the radio area, you'll need 16-inch servo leads. I routed my leads through thin cardboard tubes.

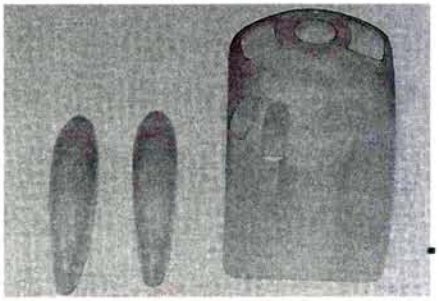


The right wing panel is complete and has been set up on the dihedral jig. The left panel is built alongside the right panel and joined to it with the dihedral brace and center ribs (30-minute epoxy was used for the center joint).



To make the aileron servo accessible, part of the aileron-servo capstrip was made into an access hatch.

• Cowl and wheel pants. Although the ABS cowl and the wheel pants that come with the kit are quite suitable, I used the Aeroglass* fiberglass cowl and wheel pants that were designed specifically for this model. With very little trimming, these parts fit perfectly; and the spray paint sticks quite well to the fiberglass.



The Aeroglass cowl and wheel pants. With a little trimming, their fit was perfect, and their scale outline matched the Citabria's profile perfectly.

Finishing and windshield/windows. I covered the plane with Coverite's* 21st Century fabric in red, white and blue. This was the first time I had used this product, and I was

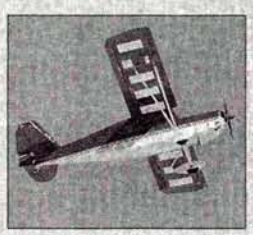
FLIGHT PERFORMANCE

by ROGER POST JR.

Incredible flight characteristics and an absolute dream to fly—that's how I would describe this plane to any interested modeler. With its 80¾-inch wing, Saito .91 and a wind loading of 20.50 oz./sq. ft., you just can't go wrong.

• Takeoff and landing

Before the test flight, I checked everything on the Citabria thoroughly. A few flight-control adjustments, a balance check and an engine run-up, and the plane was ready. There's no need to be nervous about this one; with very little right rudder to correct for torque, the Citabria lifted off the ground with a throttle setting of ½. Total ground roll was about 50 feet, and in typical tail-dragger fashion, its tail came up after about ⅓ of the ground roll had been completed. For level flight, our Citabria needed some right-aileron trim and a slight down-trim; the throttle was still set at ½.



With the throttle at idle, I turned the Citabria from base to final and lined up for landing. When the power had been reduced, I added some up-trim to achieve a steady descent. If you're into forward slips on the approach, here's your plane! With the Saito enclosed in the cowl and the Citabria in a forward slip, it sounds and looks like the real thing. The guys at the field were all impressed by its realistic performance.

Landing was as easy as landing a high-wing trainer. Control the flight path to the touchdown point, and flare a few inches off the ground. This results in a smooth, three-point landing with a fairly short rollout. I attempted crosswind landings, and the Citabria's control-surface throws handled these conditions perfectly. The Citabria's second flight ended with a deadstick landing. With its light wing loading, the Citabria glides very well; just add the necessary up-trim to achieve the best glide performance.

• Low-speed performance

With the throttle set at ¼ and up-trim added to sustain level flight, the Citabria is a very docile flier. Power-off stalls—engine at idle with the elevator stick pulled back until the stall occurred—were very gentle. There was no tendency to drop a wing, and recovery consisted of letting go of the elevator stick and adding power. Flight controls remained effective throughout.

• High-speed performance

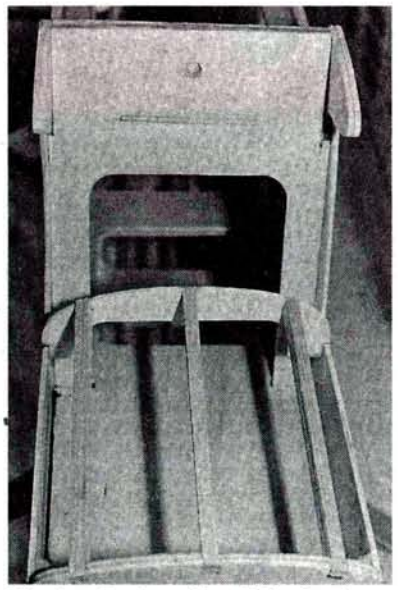
At 75-percent throttle, the Citabria can move quickly. This speed definitely isn't in the realistic, scale-flight category, but it will provide plenty of airspeed for aerobatics. Power-on stalls—full throttle with the elevator stick pulled back until the stall occurred—resulted in a drop of the nose with the wings remaining level. To recover, just let go of the elevator stick, and let the plane fly out of the stall.

• Aerobatics

Incredible knife-edge capabilities! I rolled the Citabria 90 degrees to its right and added the necessary left rudder, and it tracked as straight as an arrow for the entire length of the field. If I hadn't turned it around, it would have kept on going. For me, this was the most impressive feature of the plane's aerobatic repertoire.

When the correct control and throttle settings are used, the Citabria will effortlessly do rolls, loops, stall turns, wingovers, snap rolls and spins. Inverted flight required the obvious down-elevator, and inverted spins, flat spins, Lomcevaks and inverted flat spins were accomplished by appropriately cross-controlling the rudder and ailerons and adding the appropriate elevator input.

Make sure that you set the control throws to the recommended settings. If you happen to set up your model with control throws that are on the extreme side, be prepared to have the Citabria overreact to control inputs. This plane can fly like a docile trainer and also really wind up and tear up the sky with some incredible "airbatics." You can't go wrong with this one, and I highly recommend it for novices and expert R/C pilots.



The top, front section of the fuselage, showing the three stringers and the plywood parts that hold them in place.

impressed. Its ease of application and scale-like appearance is something to consider when choosing a covering for this airplane, or for any other fabric-covered plane. I painted the cowl and wheel pants with 21st Century paints, and these colors matched perfectly.

To install the windshield and windows, I first had to trim their edges slightly; then I glued them into place with Pacer's* RC 560. If you've had nightmares about installing these parts, you can now relax, because Midwest has made it quite easy. Midwest also offers a scale instrument panel for the Citabria.

OVERVIEW

After sitting back and looking at the finished project, I have decided this one is definitely one to keep. It isn't difficult to build or fly, and with a few weeks, you'll have a plane that you're proud of and will want to keep flying forever. It's an excellent choice for a second plane, and I recommend it to novices and experts. Enjoy a great product.

**Addresses are listed alphabetically in the Index of Manufacturers on page 184.*

About the author

This is Mike's third endeavor for Model Airplane News. He's currently building a Byron Gee Bee, another Great Planes Learjet and Cessna 182, and two LDM Industries combat planes. Needless to say, he's quite busy in his New Milford, CT, workshop.

Golden AGE OF R/C

by HAL deBOLT

HOORAY FOR HOLLYWOOD

WHEN WELL-KNOWN people become involved with any endeavor, their fame enhances its progress. Model aviation has served as a kind of kindergarten for some famous, accomplished people. Names that come to mind are Paul McCready, Hiller, Burt Rutan, George Bush and Neil Armstrong, and there have been many others. As any OT'er knows, modeling is an excellent teacher, and these people give it full credit.

Although my column this month does not relate directly to R/C, you may appreciate it as a foundation on which R/C was built. The rich and famous are often thought to be in a world of their own, so when we find them among us, we appreciate the attention they bring to our sport.

The hallmark of Denny Industries was the Dennyplane—offered as a kit, ready-built, or ready to fly—in the '40s yet!

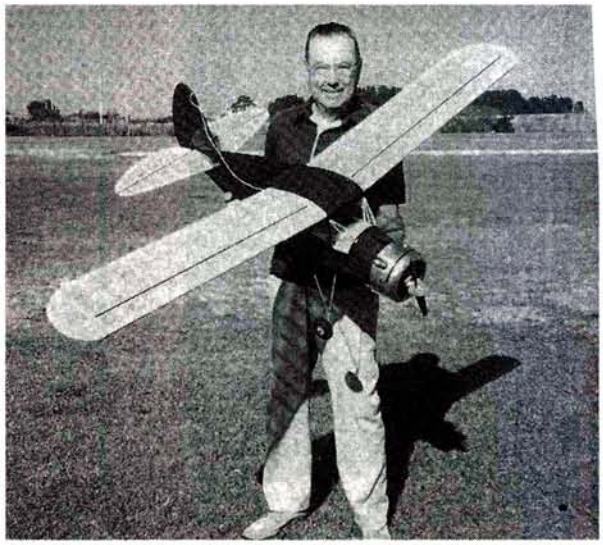
The following comes from Bill Riggert of Missoula, MT. Bill provided the info sheets that came with his Dennymite engine and Dennyplane. He said the Dennymite would "vertical" his Comet Zipper, and that was back in 1939!

Bill indicated that *Model Airplane News* has been his bible since 1934, and he still has all issues! He also said that modeling led him into the Air Force as a fighter pilot. Apparently, when his first instructor asked him where he learned to fly, he replied that he had had about 20 minutes of passenger time; all else he learned through model aviation!

ACTING AND R/C

During the '30s and early '40s, Reginald Denny, a debonair actor, graced the movie screen with the leading actresses of his day. Denny's movie characters were usually "upper crust" types whom you might not usually associate with modeling. Off-stage, however, Denny was a major factor in the hobby business for years with his Reginald Denny Industries; the business included a popular hobby shop and a production facility; Denny products included the Dennymite engine kits and ready-built "Dennyplanes," racecars and accessories such as air wheels—anything needed to complete a car or plane.

Reginald Denny's engine was a fine performer and had modern design features. Note the cost!



Shown at Valkyrie field in Florida is Joe McPhail with his docile-flying Denny replica, built by Dick Lashure of Indianapolis, IN. It's covered with MonoKote and powered by an O.S. .40 Surpass. It's a fine trainer, yet it's aerobatic. (Photo by Paul Henkle.)

It could be that Bill Atwood was involved with the design of the Dennymite, when the Brown Jr. was in all its glory, but those who used the crude-looking Dennymite claimed superior performance. Those SAM types who used Brown Jrs. can attest to how cantankerous those early engines were to start and tune—not true of the Dennymite. Compared with the Brown, the Denny could be said to be a forerunner of today's basic engine. The Brown had a steel, tube-like cylinder, with drilled holes for porting. A welded-on stamping served as the bypass cavity in this rear-exhaust design. In contrast, the Denny had an iron casting, with integral porting and a side exhaust, as is popular today. Unlike other engines of the time, Denny models also had several desirable accessories, such as various bolt-on exhaust stacks, an automatic choke and a rugged aluminum engine mount. The best that others offered was a weak wooden mount. If Reginald Denny were still alive, we'd ask why, with the success of this engine, didn't he offer more engines, or at least update the ones he had. Perhaps his movie chores claimed his time.

DENNYPLANE FEVER

When you attend SAM meets these days, it's seldom that you

ANOTHER EARLY BIRD

Many will surely recall Gary Korpi, whose early R/C exploits in California and the Nats were extraordinary. Gary, now of Yreka, CA, checked in to say that his first R/C was Ted Strader's Nomad glider with a C-S radio and powered by a Cox .02—this in the '50s! Later, he was at the first Formula One race at Turlock, CA, with a Jerry Nelson Little Toni. At 7½ pounds (4½ is the norm), the glider was too heavy to fly, or so he thought, but Cliff Weirick flew it to prove that idea wrong. Gary took time off to build a full-scale Glassair and to retire and build a house; he's now is back in R/C. Because of his association with Cliff Weirick, Gary was able to provide the following information.

PCS sales were obviously enhanced by Charlene Weirick's beautiful face, featured in their ads.

Many know Cliff as a Nats R/C champion and an AMA president. Some know of his electronics skills; he was employed by Kraft Systems as manager of Proportional Control Systems, a division of Kraft. Later, he was with Airtronics.

Cliff is appreciated for the PCS systems that he offered at a much more affordable price (at the time, the usual price for a similar system was $500; a PCS system cost only $300). This allowed those with tight budgets into propo. Kraft had a policy of introducing a new system each year. PCS was able to offer last year's system (there was nothing really wrong with it), and because there were no pre-production costs, PCS could pass the savings on to us.

With Kraft experience behind them, the PCS systems of the time were known for their outstanding reliability—nothing fancy, just meat and potatoes! For 1968, the new PCS offering was a thinner, lighter TX that featured new Kraft-Hayes gimbals. The superhet receiver added a highly effective noise-rejection circuit and new RF and logic sections (some early propo systems were subject to model-induced noise). Another sign of the advancing times was a lighter, smaller servo with capacitor feedback to alleviate nasty pot problems.

PCS advertised its system as a "sweetheart of a radio," and all of us appreciated Cliff's sweetheart, Charlene, whose picture graced the PCS ads!

don't see a replica Dennyplane. This model appears to have been one of Denny's proudest offerings, notably similar to the deHavilland Beaver and Howard's DGAS, in spite of its 50 years! Obviously, the Dennyplane was conceived as an ideal mate for the Dennymite. With its 6-foot span, it had a typical "stick and tissue" structure, dominated by the professional appearance of the spun-aluminum radial cowl. Today, you couldn't buy the cowl for what the entire kit cost then.

What was unusual for the era was that the Dennyplane could be purchased as a kit, ready-built, or ready to fly. With these choices, it's not surprising that Denny's association with Hollywood enabled him to entice famous young stars into model aviation. Freddy Bartholomew and Jackie Cooper, for example, had Dennyplanes. Freddy did well at a major meet until an over-ambitious photographer stepped in front of his plane on takeoff!

IN THE MOVIES

With his movie connections, Denny managed to get some Dennyplanes into a major production, "Holy Terror," with a young Jane Withers as one of the modelers. Denny also introduced models into the movies in a more serious manner. For whichever aircraft a movie featured, a scale model was built. These models were "flown" in studios, on wires, so to speak; this was a much cheaper and more reliable way to produce the desired action scenes. One of the first movies to use this concept was the dramatic "China Clipper." Afterward, the flying-boat model was seen hanging in Denny's hobby shop.

The use of models became a great asset to the movie industry. A later example was Dave Platt's use of R/C in the astounding action sequences in the fabulous "Battle of Britain." How much simpler it would have been if Howard Hughes could have used models in his tremendous WW I productions!

Later, modeling and R/C led to some of the first helicopters, ram-jet engines, man-powered flight, composite aircraft and even a moon landing! Modeling is not just a sport; it's also an education!

DAN MASS—WHERE ARE YOU?

In our February '96 column, we used a photo of a young R/C'er with what was thought to be a visionary model, but the old photo from our archives didn't mention his name. John Mako of Dallas, TX, wrote to say he believes the modeler is his OT friend Daniel Mass, currently of Huntington Station, Long Island, NY. John indicated that Dan was an immaculate modeler, and that he and Dan got started in C/L with Dmeco "Bipes" back in 1947. John believes that Dan Mass is still active; it would be interesting if Dan could bring us up-to-date with his experiences.

How things tie together: in our June '96 column, we mentioned Bob and Doris Riches' fantastic transcontinental R/C record. Before he ever saw that column, Jim Sullivan of Marston Mills, MA, sent us a clipping from a 1975 edition of *Model Aviation* that included the mysterious photo and Dan Mass's name! What Jim didn't realize was that the 1975 article was a challenge that explained the ramifications of flying across the continent by R/C. What would have been the reaction of the author of that '75 article (we don't know his name) when the Riches established the record with such unpretentious equipment as a C.G. Senior Falcon?

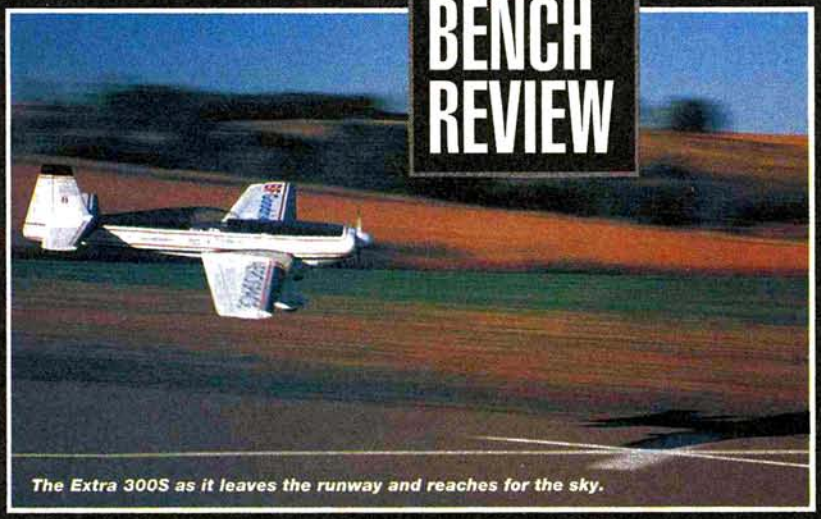
And so it was; do remember this is your OT R/C place!

MODEL AIRPLANE NEWS

FIELD & BENCH REVIEW

Extra! Extra! Read all about it!

by JIM SANDQUIST



The Extra 300S as it leaves the runway and reaches for the sky.

CARDEN AIRCRAFT 30-PERCENT SCALE *Extra 300S*

THE EXTRA 300S has come a long way in a short time. In 1992, Walter Extra introduced his first 300S in Dinslaken, Germany. The Russian Sukhoi was a threat to his Extra 300 design; the 300S was designed to bring back the handling characteristics of the Extra 260, but with better vertical performance and roll rate. The wingspan was shortened and the wing was lowered slightly to give the pilot better ground visibility. With a 300hp Lycoming engine, the Extra 300S has lived up to the expectations of its pilots.

With the Carden Aircraft* version, I think you, too, will have all of your expectations fulfilled!

THE KIT

This kit is of pretty conventional construction. The fuselage is completely stick-built, and the wings and tail surfaces are sheeted foam. The cowl, wheel pants and landing-gear cuffs were of excellent quality (virtually no pinholes to be filled), and the foam pieces were very well-cut (required only minimal sanding).

Maybe most impressive among the contents was the wood! So often, you buy a kit and find that some sheeting has worm holes or that the leading- and trailing-edge materials are warped, but this kit was topnotch.

The instruction manual and the photo pack make construction easy. The one-sheet plans are needed only when constructing the fuselage. The all-foam flying surfaces are assembled following scaled-down drawings shown in the instruction manual. Though the plans are well-drawn, you should pay close attention when looking at the top and bottom view drawings. The parts positions are shown together in one view.

Hardware wasn't supplied, but I didn't mind because I like to use specific types.

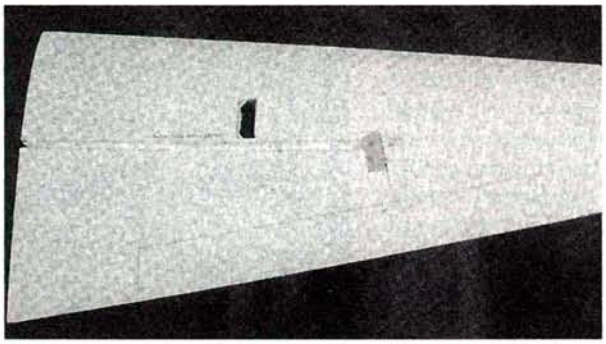
CONSTRUCTION

• Wings. Begin by gluing together 3¾-inch-wide balsa sheets; this will be used as the skin that's glued to the foam wings, horizontal and vertical stabilizer, turtle deck and hatch cover. (I used Sig's* Core Bond to stick the skin to the foam.) The "edge-trued" balsa sheets are a nice feature; you usually have to trim balsa sheeting straight before you glue the edges together. Carden has edge-trued the sheets, so if you follow the directions, everything will fit perfectly! Before you sheet the wing, cut the slot and cavity for the servo and the servo leads. The wing is supported by and attached to the fuselage with a 1½-inch-diameter aluminum wing tube that goes into a pre-cut slot in the wing.

PHOTOS BY JIM SANDQUIST

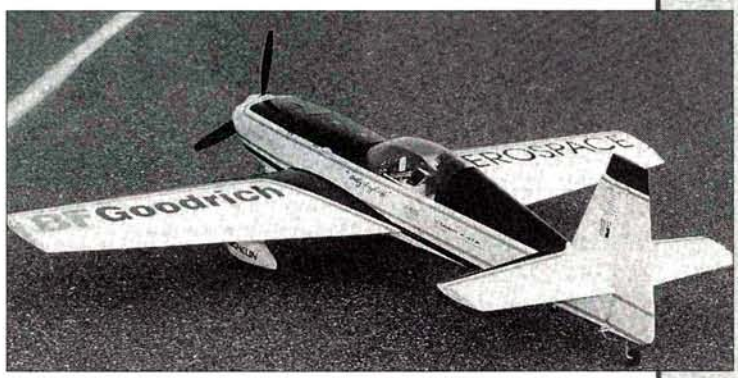
• **Fuselage.** Construct this over the plans—completely stick-built with plywood sides. The materials in the fuselage are more than adequate to take the type of flight stress to which this plane will be subjected and to withstand the vibration of a large gas engine.

Fitting the wing tube into the fuselage is one of two critical construction tasks. Carden has done a nice job of cutting the critical pieces and explaining how to complete this part of the construction. If you follow their instructions, you won't have problems and you'll have a straight, true wing. The other critical task is establishing the correct horizontal-stabilizer incidence. Like the wing, the saddle for the stabilizer is pre-cut, so it's really impossible for you to mount it incorrectly. The landing gear is made of ¼-inch-thick aluminum stock and is bolted directly to the bottom of the fuselage. The gear's wide stance gives very reliable ground handling.



Construction starts with the wing. You cut the slots in the foam for the servo and the servo-wire lead; the aileron is cut out of the wing after it has been sheeted.

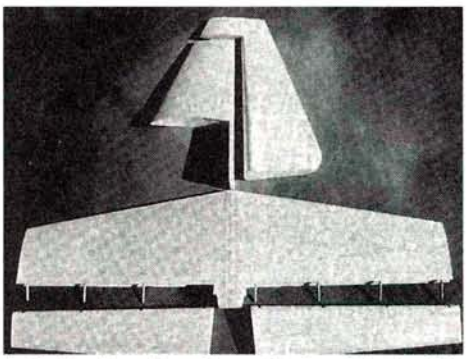
I was impressed with the technique used to mount the fiberglass cowl. This cowl has a ring that you glue inside it at the rear. When the cowl is in place, it's held on by four bolts and blind nuts that are hidden under the hatch cover. This method not only eliminates mounting problems, but it also hides any unsightly large external bolts that are used for cowl attachments.



COVER AND FINISH

This plane was designed to be light; with that in mind, the recommended covering would be iron-on materials. I used a combination of Sig silkspan and Koverall—silkspan on the areas that needed to look like metal, and Koverall to replicate the fabric areas on the full-size plane. I covered both with a butyrate dope finish. (If you aren't familiar with this painting process, get out your May 1995 issue of *Model Airplane News;* it contains an article I wrote about this.) The paint adds more weight than an iron-on covering, but the plane's performance hasn't suffered and I prefer a painted finish.

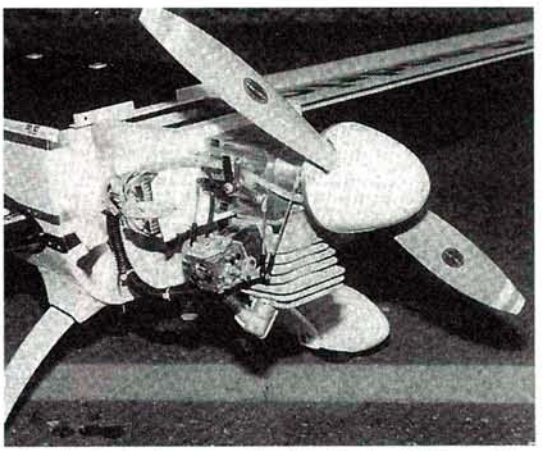
I really like the color scheme of Patty Wagstaff's Extra 300. To replicate this, I used Bob Banka's Scale Model Research*. If you have not seen Bob's catalogue, you should. It shows thousands of airplanes and descriptions of the "Foto-Paaks" he has available. With the help of the photos of Patty's airplane, it was easy to position the markings, and little scale details were easily added during construction and painting.



Left: like the wing, the vertical and horizontal stabilizer are sheeted foam. Here are the finished parts ready to be glued to the fuselage.

ENGINE AND RADIO INSTALLATION

Carden recommends a 3 to 4.2ci engine. I wanted plenty of vertical performance and chose a 4.2 Sachs engine from Brison Aircraft*. With the



There's plenty of room up front for the installation of the Brison Sachs 4.2, the CH Electronics ignition and the B&B Specialties smoke system.

SPECIFICATIONS

Model: Extra 300S

Manufacturer: Carden Aircraft

Type: 30-percent scale

Wingspan: 89 in.

Wing area: 1,460 sq. in.

Weight: 19 to 21 lb.

Wing loading: 31.56 lb./sq. ft. (calculated at 20 lb.)

Length: 78 in.

Engine: Brison Sachs 4.2

No. of channels req'd: 4

Radio used: Hitec Prism 7

Prop used: Clark 22x12

Airfoil type: symmetrical

List prices: $449 (kit); vinyl lettering packages—$129 (Patty Wagstaff), $89 (John Lillberg), $129 (Phil Knight).

Features: well-drawn plans; sheeted-foam wing; built-up balsa and plywood fuselage; high-quality wood and foam components; edge-trued balsa sheeting; excellent fiberglass cowl, wheel pants and landing-gear cuffs (no ABS!); accurate paint-scheme marking dimensions for the Lillberg 300S paint scheme.

Comments: this high-quality Carden kit has to be one of the best Extra 300S's on the market. It's easy to build, goes together quickly and flies really well.

Hits

- Can be built quickly.
- Good instructions.
- High-quality materials.
- Excellent flight characteristics.

Misses

- No hardware (only some of you will think this is a "miss").

FLIGHT PERFORMANCE

• Takeoff and landing

"Simple and straightforward" pretty much sums it up. Takeoff rolls are straight and require very little rudder correction. My plane left the ground at about half throttle.

Landings were only slightly more difficult than with a typical sport

plane. Set up your approach angle and gradually pull back the throttle. When the plane is approaching the end of the runway, start to add up-elevator, holding the nose off to settle in for a three-point landing. Because the plane seems to be able to get up and down in a relatively short distance, it would make a good plane for pilots who fly off smaller fields.

• High-speed performance

This plane is rock-solid. At full power, it tracks true through every maneuver. With all the controls set at the maximum recommended throws, the plane was very predictable.

• Low-speed performance

At lower speeds, the Extra 300S is a pussycat. When testing the stall characteristics, I held in up-elevator and bled the power off to just above idle. The plane never showed any tendency to tip-stall, and it had a predictable, slow sink rate. All controls are effective, even in slow flight.

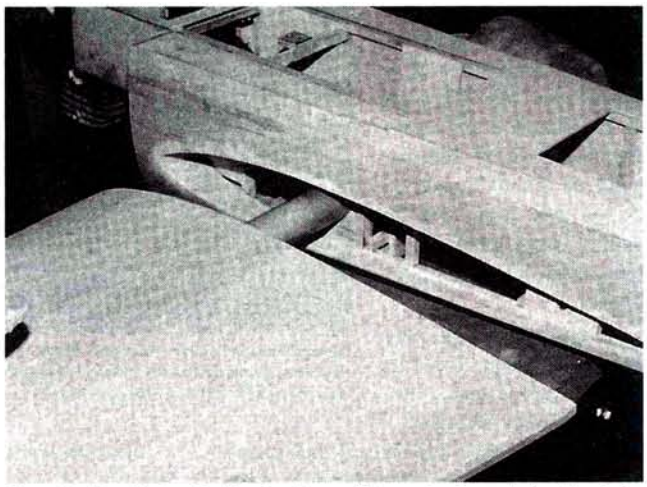
• Aerobatics

I balanced my plane about ¼ inch aft of the recommended CG and set all the control throws to the recommended maximums. The plane was solid in flight and solid and predictable throughout all maneuvers. Four-point rolls need little input other than aileron; inverted flight needs little or no elevator correction. Snaps begin the instant you hit the sticks and stop just as fast when the sticks are released. With this plane, knife-edge, hammerheads, slow rolls and big impressive loops are all within the capabilities of the average pilot.

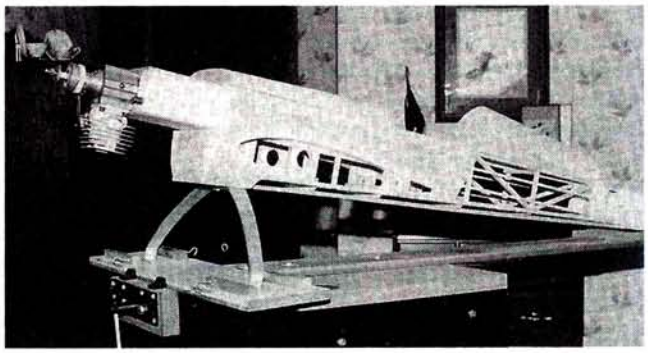
included ignition system from CH Electronics*, throttle response is smooth throughout the entire power curve, and idle is extremely reliable. With a 22x12 propeller and a Slimline* Pitts-type muffler, I was able to obtain 6,800rpm with a static thrust of approximately 30 pounds, and the sound meter indicated 98dB.

I added a smoke system from B&B Specialties*. Unlike other smoke systems, this one is completely mechanical and runs off crankcase pressure; it has given me years of trouble-free use. I have tried a number of smoke oils, but the oil from B&B seems to work best. A plane like this really needs smoke.

I used a Hitec* Prism 7 PCM radio with Hitec's new high-torque metal-geared ball-bearing servos. These servos are in a case of standard size, but they have the benefit of high torque. Plan to use two servos for the elevator, two for ailerons, one for rudder, one for throttle and one for smoke (if you choose to use it).



The wing is attached to the fuselage with an aluminum tube. The tube slides into the fuselage and is captured by an anti-rotation pin and a bolt.



The completed fuselage with the Brison engine and landing gear in place. The fuselage is stick and plywood construction.

CONCLUSION

There are a number of Extra 300S kits available. I haven't seen them all, but this high-quality Carden kit has to be one of the best. The kit is of high quality, and its conventional construction makes it easy to build quickly. If you have any questions or doubts give Dennis Gergits a call at Carden [(407) 367-7744]. He will answer all your questions; and be sure to have your credit card handy, because you'll probably be placing an order by the end of your conversation!

**Addresses are listed alphabetically in the Index of Manufacturers on page 184.*

The panel lines, louvers and Du-Bro* no. 2 button-head screws on the cowl add the final scale touches.

About the author

Jim Sandquist of Oakdale, MN, has been an R/C pilot for 12 years and a contributor to Model Airplane News for the last three. Jim has been in competition scale for four years, and he flew at Top Gun in 1994 and 1995 as well as at the Scale Masters in 1995. For the past three years, he has been sponsored by Red Baron Pizza, and he has campaigned his popular ¼-scale Super Stearman at many scale competitions.

MODEL AIRPLANE NEWS

HOW TO

COMMERCIAL COWLS are seldom available for original-design models, so you have to design and make your own. This article describes how to design a cowl and gives step-by-step instructions on how to mold a high-quality fiberglass cowl.

Design and Build a Fiberglass

by ROY DAY

Professional techniques for making molds

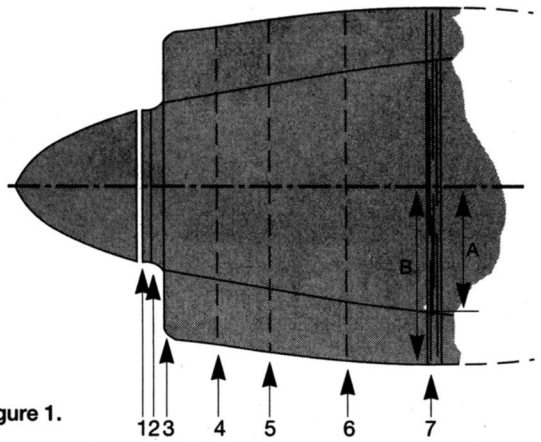


Figure 1.

Fiberglass cowls may be made in two ways:

- Fiberglass cloth is laid up over a foam plug, and then the foam is dug out or dissolved with acetone.
- Fiberglass cloth and resin are laid up over a plug to make a female mold; then the actual cowl is laid up in this mold.

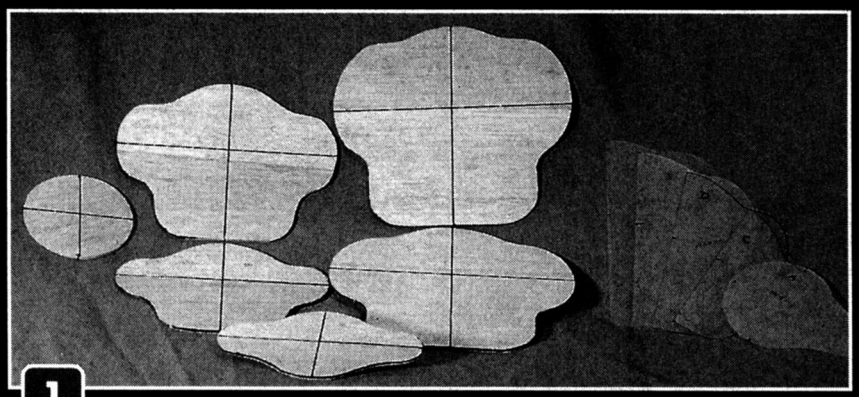
Though it's relatively simple, the first method has two disadvantages:

- If you need a replacement cowl, you must make a new plug; this is time-consuming.
- The cowl's surface is usually rough and requires considerable finishing.

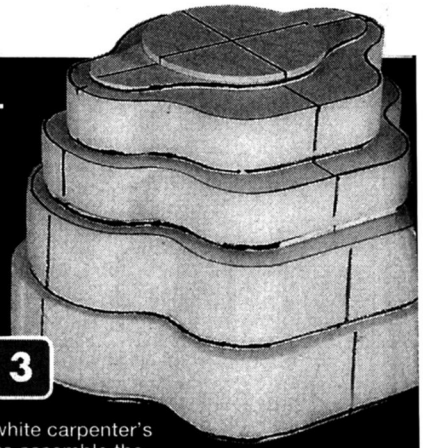
The second method is more complicated and takes more time, but it has two distinct advantages:

- If the plug has a good finish, the resulting female mold and the final cowl will have a very smooth surface that requires little or no finishing.
- Additional identical cowls can be made quickly.

TO BUILD THE PLUG, FOLLOW THE STEPS SHOWN IN THE PHOTOS.

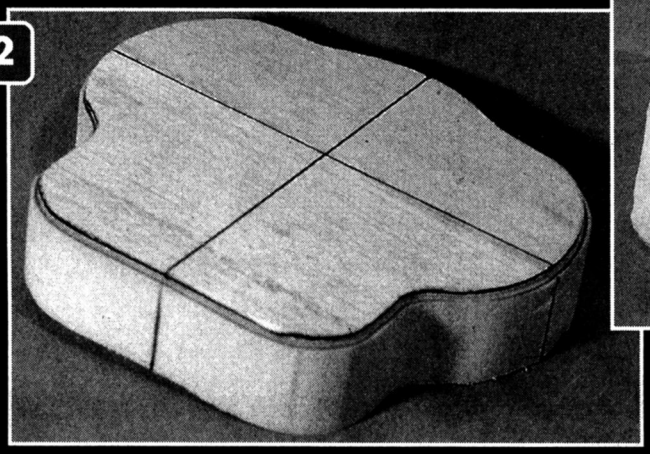


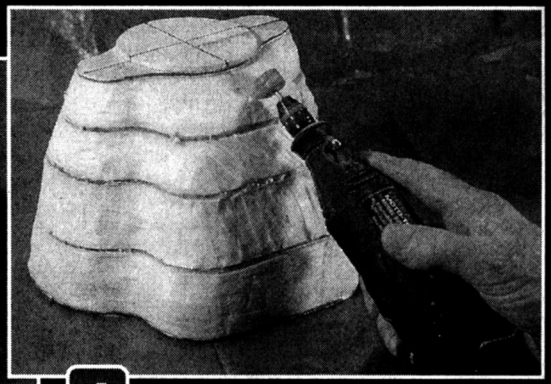
1 Make the templates out of sheet balsa; they'll be sandwiched between the foam blanks and will give you the plug's basic shape.



3 Use white carpenter's glue to assemble the stack. Blacken the edges of the balsa templates with a felt-tip pen; this will help when you final-sand the foam when making the plug.

2 Use your scroll saw or band saw to make the foam blanks. To align the parts, transfer reference marks from the balsa templates to the foam blanks.





4 Use a Dremel Moto-Tool with a sanding drum to rough-carve the foam, then sand to final shape. A very smooth finish is important; any defects in the plug will be faithfully reproduced in your final cowl.

Cowl

DESIGNING THE COWL

Figures 1 and 2 show the top and side of a typical cowl. Three-view drawings usually give you these views but seldom any cross-sections; you will have to draw your own. Using the dimensions of "A" and "B," draw the cowl cross-section (at the firewall—station 7), which is shown on the side view.

Now make a template using See-Temp* material and draw station 7 as shown in Figure 3. To draw the other cross-sections, you need to establish additional stations (cuts through the cowl). The spaces between the stations shown in Figure 2 are the same dimension as the thickness of layers of the foam and balsa sheet that are sandwiched together to build the plug (more on that later).

With the stations 1 through 7 shown on Figure 2, lay out the dimensions of "A" and "B" for each station, and draw in the cross-sections as shown in Figure 3.

Follow the general contour of station 7 so that your cowl will have a smooth shape. The method is the age-old technique of "lofting." With this information you can now build the plug.

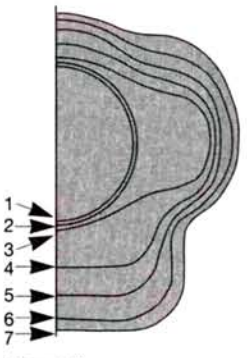
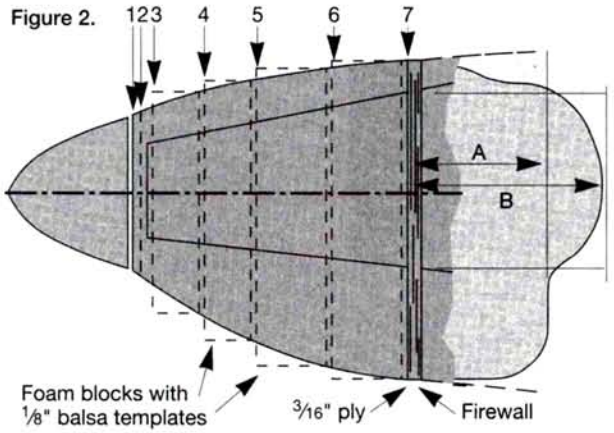


Figure 3.

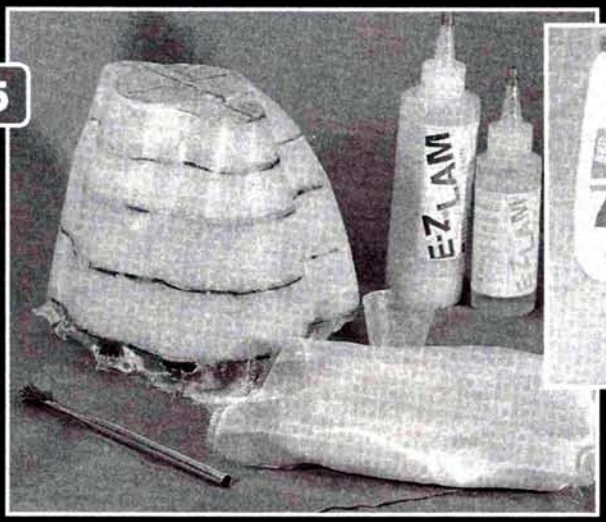
BUILDING THE PLUG

I made the plug out of four blanks of foam (use either pink or blue) stacked with balsa templates between them. The 1-inch or the 1½-inch foam is the common sheet foam used for building insulation. You might be able to get damaged sheets free from your building supplier. The balsa templates are the cross-sections at each of the stations. To complete the front of the plug, add additional balsa templates. To give the plug a strong base, the station 7 template was made of 3/16-inch-thick plywood. The foam blanks will be shaped and sanded to the contour of the balsa templates.

Figure 2.

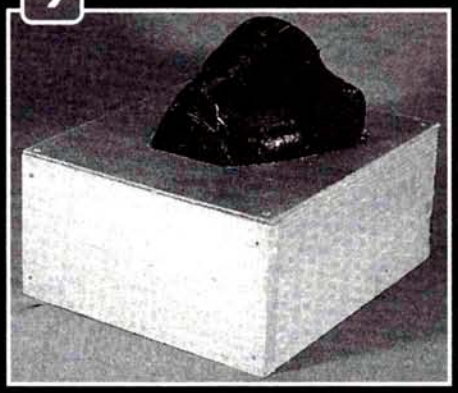


5 To ensure that the plug has a good surface, apply one layer of light fiberglass cloth (0.75 ounce per square yard) with epoxy resin. (Be sure to wear rubber gloves to protect your hands.) When this has cured, sand lightly and then brush on a coat of epoxy resin. Alternatively, you may just brush on two coats of resin without any cloth. Be sure to cover the cloth completely so that when you add the primer coat, it won't be able to get through any pinholes and attack the foam. If you can find a foam-compatible epoxy-based primer, so much the better. I could not.



8 Clean the plug with water and a household cleaner.

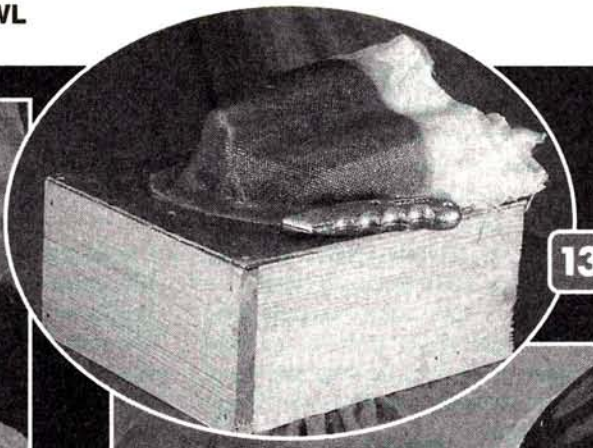
9 Using scrap lumber, build a three-sided box and top it with Masonite®. Make a cutout that allows the plug to fit neatly into the top, and support it inside the box so that one half of the plug projects above the Masonite's surface.



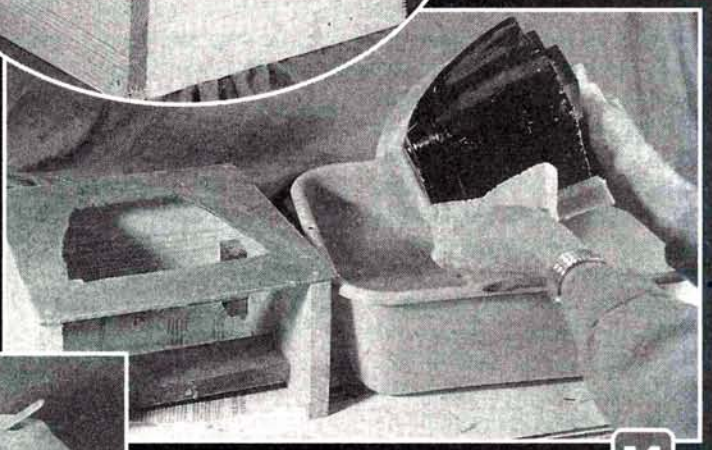
6 Next, apply a coat of sandable primer and check for any imperfections in the finish. If you find any, apply a filler, sand it, and then apply another coat of primer. Very lightly sand this final primer coat.

7 Spray on one or two coats of automobile black lacquer, being careful not to get any runs that would mar the finish. You have now completed the plug and are ready to begin the fiberglass lay-up.

10 Apply parting wax to the plug and the Masonite box top and buff it to a good shine. You'll need three coats, allowing 1 hour between each coat. Be sure the wax doesn't contain silicone, because silicone will prevent the paint from sticking to your finished cowl.



13 When the lay-up has partially hardened (about an hour), trim it with a knife leaving a 1-inch flange on the board. Let this cure for 24 hours.



14 Pry the lay-up off the box and clean it with warm water. Remove any excess clay. Use your saber saw to enlarge the box's top opening so that the plug can be inverted and supported on the flange.

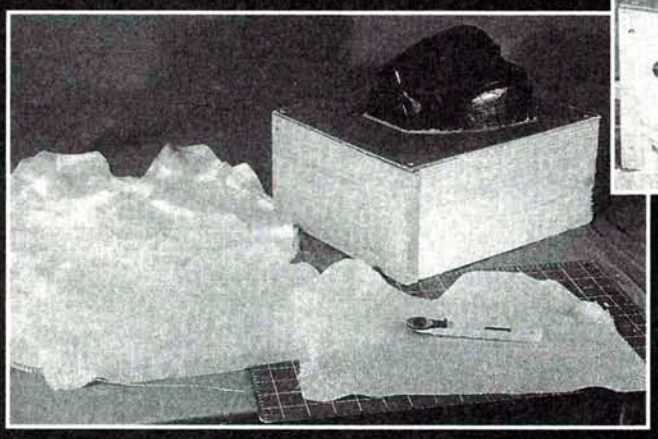
Seal the gap between the plug and the Masonite top with an oil-based modeling clay, using a plastic putty knife to make a neat joint. Wax one more time, then buff and you're ready to apply the release agent—polyvinyl alcohol (PVA). Brush on three coats of the PVA, allowing 10 minutes between coats and 1 hour after the final coat for the PVA to dry.

11

Now repeat the process for the other half of the female mold. First, apply the three coats of wax, then the three coats of PVA—always allowing the appropriate curing times. Then brush on surface coats of resin with the silica added. Next, add the reinforcing putty (made with microballoons and resin) around the nose edges and where the seam will be. Finally, add a base coat of resin and then the layers of fiberglass cloth and resin. When partially cured, trim with a knife.

15

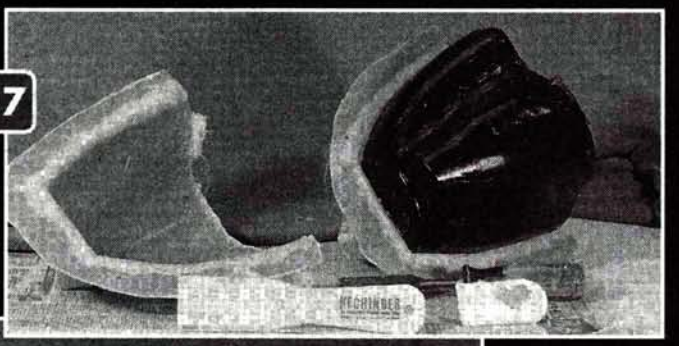
12 You're now ready to begin the lay-up. First, apply a surface coat of resin (thickened with silica) over the exposed plug half, and extend this coating out 1 inch onto the Masonite around the base of plug. This will be the parting surface of the female mold. If you add a few drops of a color (white or yellow) to the resin, it will be easier to see when you brush it on. Before adding a second coat, allow the surface coat to harden partially (about one hour); then cut out all the pieces of fiberglass cloth you will need: four layers of 3-ounce-per-square-yard cloth and six layers of 6-ounce cloth. A rotary cutter speeds the cutting.



Now make a putty of phenolic microballoons and resin, and spread it around the plug's nose edges and along the plug/box joint to reinforce these areas. Next, apply a base coat of resin, being careful not to disturb the putty. Follow this with the lay-up of cloth and resin: four layers of the 3-ounce cloth, followed by the 6-ounce cloth.

16 When the mold has cured for 72 hours, drill four holes in the flange for the alignment bolts.

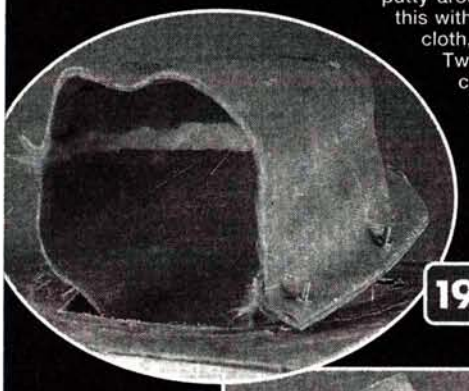
Pry the mold halves apart with a plastic putty knife and some plywood wedges. Grind off any flashing; polish the inside of the mold with 400-grit sandpaper, and then wash the mold thoroughly.



17

18

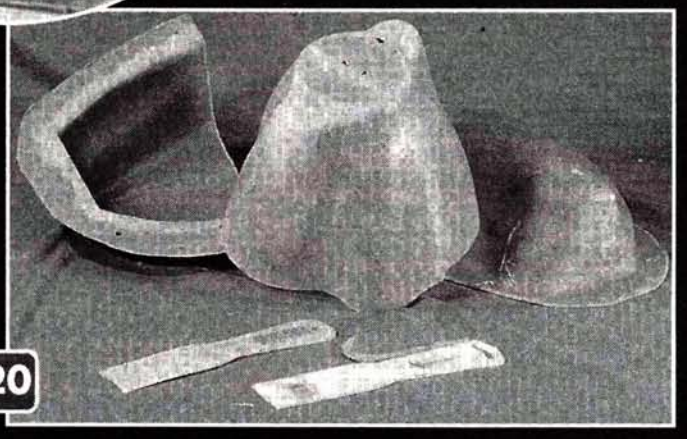
Now you are ready to lay up your cowl in the female mold. You will do this in each mold half and then join them when the lay-ups have partially cured. First, prepare the mold halves with the three coats of parting wax and the three coats of PVA, allowing the proper drying times between coats. Next, brush on two surface coats (containing the silica), allowing about 30 minutes between coats. Then apply a little putty around the nose area for reinforcement. Follow this with a coat of resin, put on one layer of 3-ounce cloth, and follow it with one layer of 6-ounce cloth. Two layers of cloth and resin are usually sufficient. Let this cure partially for about one hour, and then trim with a knife.



19

Join the halves using the four alignment bolts. Spread a little microballoon/resin putty along the joint, and add fiberglass tape. Allow 24 hours for this to cure.

When the cowl has cured for 24 hours, separate the mold halves with your plywood wedges and plastic putty knife. Remove the cowl from the mold and wash it. When you've trimmed off any rough edges, you're ready to prime and paint the cowl.



20

This method generally follows the literature and a video available from Fibre Glast Development*, which can supply all the required materials. With time and patience, you'll produce a cowl that will look as good as any that are commercially available.

Addresses are listed alphabetically in the Index of Manufacturers on page 184.

by GERRY YARRISH

AFTER a particularly cold New England winter, I was happy to head to the annual R/C World Big-Bird Fly-In hosted by the R/C World Flyers of Orlando, FL. Held on March 16 and 17, this year's event honored retiring AMA President Don Lowe. At the Saturday night reception, the club presented Don with a plaque, a custom-embroidered cap and jacket from the Melrose Co.* and a JR* radio for his years of service to the AMA and the sport of R/C. Don also enjoyed himself at the field and showed off his talents as an R/C flier.

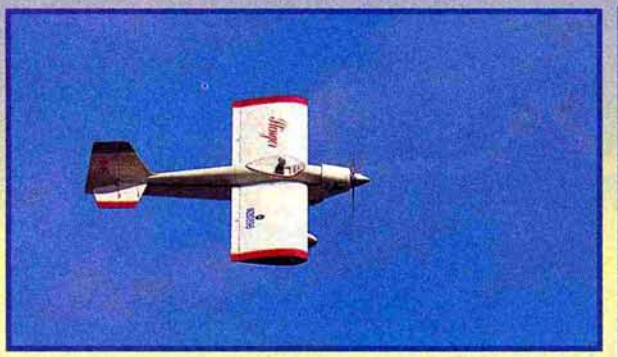
Another sun-and-fun Florida attraction

R/C World Big-Bird Fly-In

PHOTOS BY GER

The Lockheed Constellation on the wing. It was flown every day, and the spectators loved it.

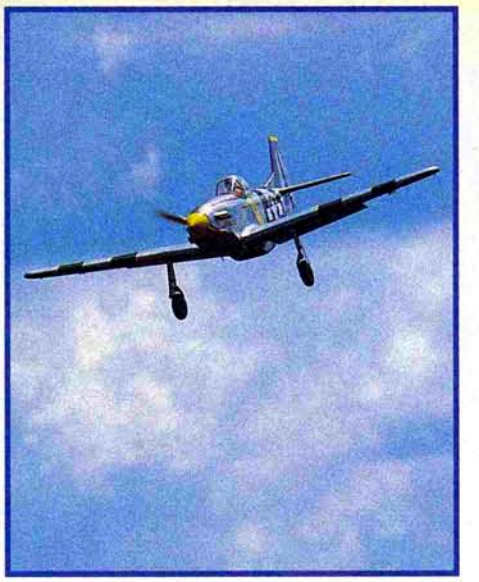
Eric Dern starts up the gigantic Connie while his helpers hold on.



Jerry Smith—designer of Lanier's Stinger series—flew his original Giant Stinger prototype; Saito 270 for power.

This hot pink Carden Aircraft 30-percent-scale Extra 300s was built and flown by Gary Ballard. It has an 89-inch span and is powered by a Sachs* 3.2ci gas engine.*

John Chevalier of Lacolle, Quebec, Canada, took Best Civilian with his scratch-built PA-22-108 Piper Colt—a replica of his full-size Colt; 29 pounds; 116-inch span; Quadra 52S engine.*



A nice flight shot of James Boyd's P-51 Mustang—The Flying Undertaker—which took the Best Military award; Sachs engine; 35 pounds; 101-inch span; flaps and retracts.

This good-looking aircraft by Rod Gier of Cocoa, FL, looks like a modified Hobby Lobby Giant Telemaster. Rod calls it the "Eagle 105"; 28 pounds; 13-foot span; Saito 300T for power.*

R/C WORLD

Just a few minutes away from the Orlando International Airport, R/C World is a well-designed condominium complex especially built for people who love R/C. You become aware of this as you drive down R/C World Blvd. and see street signs such as Stearman Ct., Skybolt Dr. and Inside Loop. At the end of your drive through the complex, a gate leads you to the flying field, where there is ample parking and a clubhouse ("The Hangar"), which set the stage for a great weekend of fun and relaxing flying.

The 450-foot-long paved runway is perfectly situated with respect to the sun, and the pit area is well-protected by a safety fence. The flying field is in the middle of 100 acres owned by the R/C World Flyers, so the facility is sure to be around for a very long time, and it's unlikely that there will be noise complaints from the neighbors. The entire complex just beckons R/C pilots to pull up stakes and move to Florida when it's time to retire.

Award Winners

Award	Modeler	Model
Best of Show	Irvin Barber	Christen Eagle
Best Civilian	John Chevalier	Piper Colt
Best Military	James Boyd	P-51 Mustang
Technical Achievement	Ernie McCall	Prime Cut Twin
Best Crash	Norm Holland	Gee Bee

Dennis Gergits of Carden Aircraft flew his 35-percent-scale Extra 300S demo model and handed his transmitter around. Powered by a 5.8ci engine, the 26-pound, 103-inch-span Extra is a real performer.

AT THE FIELD

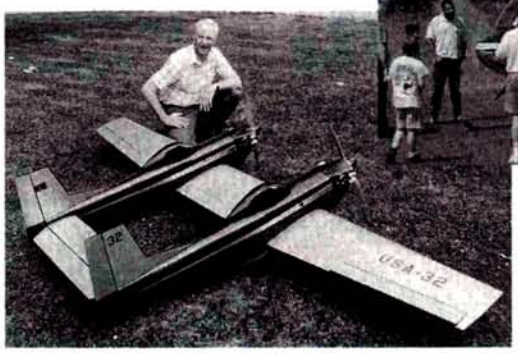
Flying is what the Big Bird Fly-In is all about, and though this wasn't the biggest event you'd ever see, it certainly had a lot of entertainment value. CD Arnold Marcus, co-CD Dixie Cutrone, announcer Vernon Peckham and all the club members who ran the flight line and radio-impound area did a bang-up job.

The arrival of an Orlando Sheriff's Dept. helicopter surprised everyone. Piloted by club member Cris Bell, the heli landed right in the middle of the large auxiliary field and was then on public display. When he left, Cris treated us to a couple of low-level passes down the runway—great for the kids, both young and old.

I was pleased to meet many well-known R/C pilots and see them fly. Good friend Mike Stokes of JR flew his impressive Weeks Special biplane in typical TOC style. Scratch-built from Miles Reed plans, the model was enlarged by 12 percent and powered by a D&B 3.7ci engine running on glow fuel. Another very hot pilot was Jason Shulman, who flew the 102-inch-span Extra 260 with which he placed sixth at the '94 TOC. Powered by a Desert Aircraft* 3-W 70 engine, this model was quite a sight, and I don't think I'll ever figure out how he does those big rolling loops!

Showing off his new jacket and cap, retiring AMA President Don Lowe smiles for the camera. (Photo by Jerry Smith.)

Famous for designing the Stinger series of models produced by Lanier RC*, Jerry Smith of Acworth, GA, flew his original, 84-inch-span, 18-pound Giant Stinger prototype using a Saito* 270 for power. Jerry also helped design Lanier's 1/4- and 1/3-scale Laser 200s and the 1/3-scale Extra 300S. I wonder what's up his sleeve for his next design?



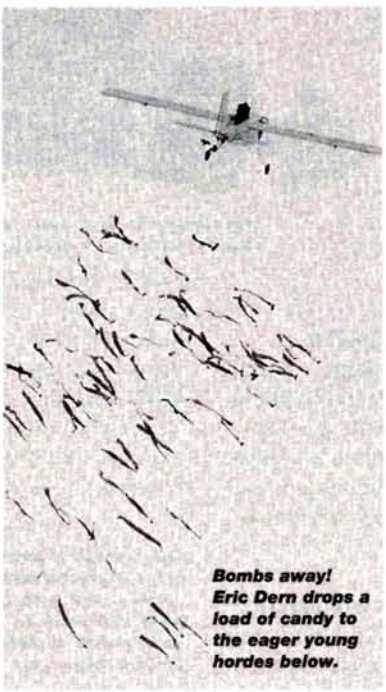
Winner of the Technical Achievement award, Ernie McCall, poses with his Prime Cut twin; 123-inch span; two receivers; 11 servos; Likes Line retracts; two Saito FA 300T 4-strokes.*

And last, but certainly not least, was an impressive, 16-foot-span, 4-engine Lockheed Constellation. Beautifully built by Eric Dern and flown by Don Lowe, this classic airliner performed flawlessly, and it instantly brought back memories of a simpler and classier mode of air transportation. With a fiberglass fuselage, plug-in wooden wings and a bolt-on tail, the Connie was just as impressive in the pits as it was on the wing.

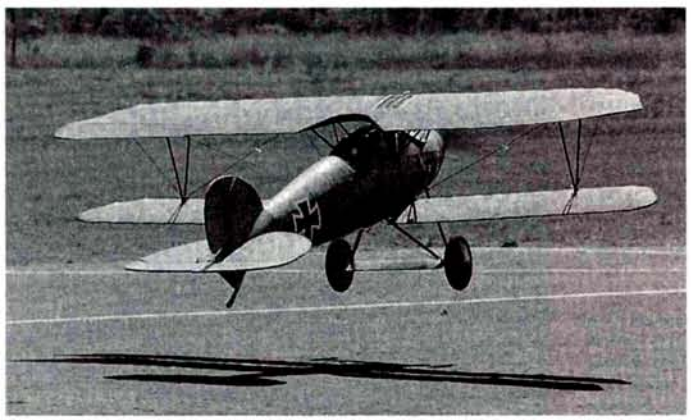
The Orlando Sheriff's Dept. got in on the act with their helicopter piloted by R/C World member Officer Cris Bell.

Eric is known as the "Candy Man," because he pilots the very popular (at least among the kids) candy-drop plane at the yearly event. At the end of each day, Eric cranks up his big yellow model and expertly drops streamer-trailing candies right into the waiting arms of the dozens of kids who go nuts when the bomb-bay doors open. Don't get in their way!

The R/C World Flyers are doing a wonderful job of keeping the fun and entertainment in R/C, and they really have the public-relations part of the hobby finely honed. If you ever find yourself in Orlando, check out this unusual Florida attraction. For information on the R/C World Big-Bird Fly-In, contact Dixie Cutrone, 1325 N. Tropical Trail, Merritt Island, FL 32953-6036.



Bombs away! Eric Dern drops a load of candy to the eager young hordes below.



Rich Feroldi of Winter Springs, FL, flew his impressive WW I German Albatros; 35 pounds; 110-inch span; A&M 5.8 engine. Majestic flier.

**Addresses are listed alphabetically in the Index of Manufacturers on page 184.*

MODEL AIRPLANE NEWS

ENGINE REVIEW

by MIKE BILLINTON

MDS .46 ABC

Precision-fit and performance in a sport engine

THE RUSSIANS are coming! For years, this was the West's biggest fear, and now it's happening. But these Russians are very small and pose no threat. Produced some 60 miles north of Moscow by SAVMA and distributed in the U.S. by Estes Industries*, the new MDS .46 ABC Aero engine is very impressive.

The engine's top-quality engineering partway explains recent Russian successes in international modeling events. How many engines can there be that have crankshaft nose threads produced by the super-accurate *grinding* process? This is hardly a necessity, but it surely indicates this manufacturer's determination to produce a high-quality product.

To date, the marketing of MDS engines has been fairly low-key, though this now seems to be changing. Perhaps the inferior carburetor in the first run of these engines masked their inherent quality and impeded their marketability? Fortunately, SAVMA's willingness to accept constructive criticism has resulted in a new "machined from solid" Mk 2 Aeromix carburetor, so the engine's operations and control have been transformed.

The MDS .46 proved virtually faultless in all important areas and, in particular, the ABC piston/liner combination is of exemplary quality; it has a really smooth cold fit that eases very slightly as the engine heats up. This arrangement can hardly be improved on.

MECHANICAL POINTS

• **One-piece crankcase casting**—a sound original design (not the all-too-common O.S. copy) that's more robust than most .40ci engines. The internal finish is of high quality, but the external appearance is not quite up to that high standard (only a cosmetic defect).

• **Twin-needle Aeromix carburetor.** Finely constructed of solid aluminum alloy, it's fitted with two O-rings and has a very solid main fuel-control needle that gives predictable, unwavering engine response. (In my experience, only one other engine—the Fitzpatrick 61—is better in this regard.) With a 12x6 Graupner prop, the high-end needle's narrow taper and fine threads combined to give a quite broad, but acceptable, range of needle control and a very steady, low idling speed of 1,700rpm and a swift unhesitating pick-up to full-throttle running.

• **Exhaust timing.** At 156 degrees, this is slightly high for a "sport" engine, and it probably contributes to the unusually high rpm at which maximum horsepower occurs. Two normal Schnuerle side transfer ports are supplemented by two wide boost ports that also assist this high-rpm design concept. Timing overlap (between exhaust and the low-timed transfer) is a generous 20 degrees and makes the MDS .46 a suitable candidate for effective tuned-pipe operation. Of course, this engine can easily take the extra stresses that would result from the probable increase in horsepower.

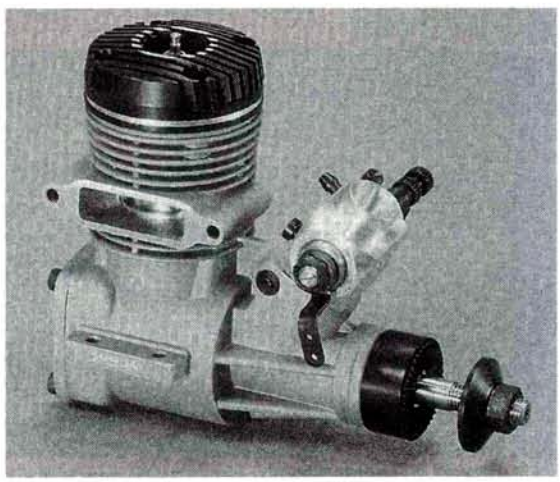
• **Fine workmanship.** The finest has been reserved for the essential rotating parts: crankshaft, piston and connecting rod and the cylinder liner itself. They form an impressive package that's at the top level of what's currently available anywhere. The superb friction-free fit of these parts is definitely a major contributor to this engine's above-average, high-rpm capability.

The silencer is very solid and easy to fit; sound is virtually at regulation levels.

PERFORMANCE

SAVMA personnel obviously know what's needed to obtain racing performance because the MDS .46's very low internal friction led to a definite bias toward high rpm; at the more used "sport" speeds up to 14,000rpm, the available performance was at good average levels for an engine of this size. Development is under way to harness this performance bias downward to more usable rpm. Meanwhile, having been designed for high-rpm use, the engine must be that much more durable when operated at more sedate levels around 9,000rpm to 13,000rpm.

• **Test 1. Open exhaust.** *Fuel: 5 percent nitro, 10 percent castor, 10 percent*



The new Mk 2 Aeromix carb is a great improvement on the earlier version, and with double O-ring seals and seals on the main and idle needles, it gives very steady, precise responses.

WEIGHTS AND DIMENSIONS

Capacity	0.455ci (7.454cc)
Bore	0.859 in. (21.82mm)
Stroke	0.785 in. (19.94mm)
Stroke/bore ratio	0.941:1
Timing periods	Exhaust—156° Transfer—116° (angled up 15°) Boost—112° (angled up 60°) Front induction —Opens 40° ABDC —Closes 48° ATDC —Total period 188° —Blowdown 20°
Combustion volume	0.7cc
Compression ratios	Geometric—11.64:1 Effective—8.2:1
Exhaust-port height	0.225 in. (6.50mm)/ 0.653in. (16.6mm)
Cylinder-head squish	0.014 in. (0.034mm)
Cylinder-head squish angle	0°
Squish-band width	0.128 in. (3.27mm)
Carburetor bore	0.314 in. (8mm)
Crankshaft diameter	0.590 in. (15mm)
Crankpin bore	0.414 in. (10.54mm)
Crankpin diameter	0.235 in. (5.98mm)
Crankshaft nose thread	0.246 in x 28 TPI (1/4 UNF)
Wristpin diameter	0.196 in. (5mm)
Connecting-rod length —center to center	1.42 in. (36mm nominal)
Engine height	3.57 in.(90.7mm)
Width	2.043 in.(51.9mm)
Length	3.48 in. (88.38mm)
Width between bearers	1.52 in. (38.64mm)
Mounting-hole dimensions	1.73x0.708x0.127 in. (44x18x3.25mm)
Exhaust-manifold bolt spacing	1.650 in. (42mm nominal)
Frontal area	5.75 (bare) 8.69 sq. in. (w/silencer)
Weight	Bare—13.95 oz.(395gm); w/silencer—19.15 oz. (543g.)
Crankshaft weight	2.4 oz. (69gm)

PERFORMANCE

Maximum B.hp: 1.51 @ 22,200rpm (open exhaust/5% nitro)
1.10 @ 17,780rpm (standard silencer/ 5% nitro)

Maximum torque: 83 oz.-in. @ 10,277rpm (open exhaust)
75 oz.-in. @ 9,798rpm (standard silencer)

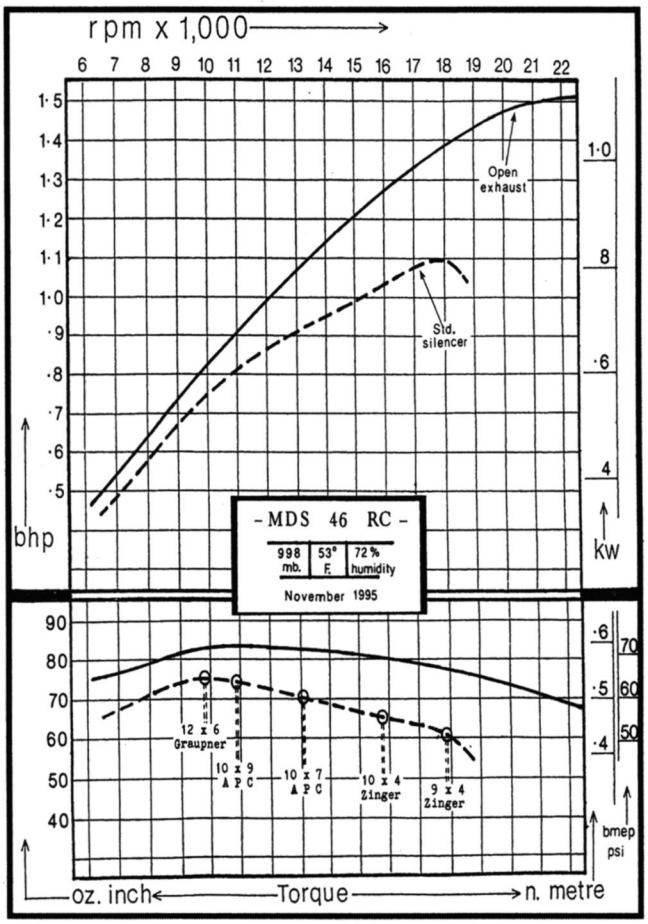
RPM ON STANDARD PROPELLERS

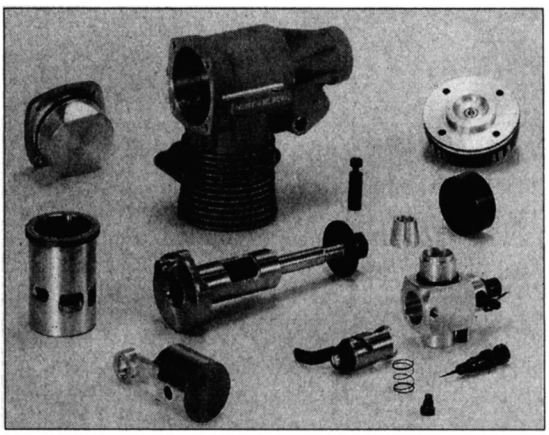
Prop	Open Ex.	Std. Silencer
15x6 Airflow	6,200	–
13x6 MK	9,260	–
12x6 Graupner	10,200	9,780
10x9 APC	11,200	10,710
10x6 MK	13,240	12,320
10x7 APC	13,690	13,010
10x4 Zinger	16,460	15,760

Performance equivalents

Prop	Open Ex.	Std. Silencer
B.hp/ci	3.320	2.420
B.hp/cc.	0.202	0 .147
B.hp/lb.	1.730	0 .919
B.hp/kilo	3.820	2.020
B.hp/sq.in. frontal area	0.263	0.126
Oz.-in./ci	182.400	164.800
Oz.-in./cc	11.130	10.060
Oz-in./lb	95.180	62.650
Nm./cc	0.079	0.072

Manufacturer: SAVMA, Kimri, Tver Region, Russia.
U.S. distributor: Estes Industries, 1295 H St., Penrose, CO 81240.





PHOTOS BY MIKE KELLEHER

The stronger-than-average one-piece crankcase is a sound platform for elevated hp levels. The short, well-sealed, main fuel needle gives very precise control of rpm.

ML70 synthetic oils and methanol. Supplied glow plug.

The MDS .46 revealed a very wide-ranging, flat torque band that's typical of a well-set-up, free-rolling, easy-breathing racing engine. It could probably have gone a fair way higher up the rpm scale before declining significantly. But in test runs, I always avoid destroying an engine—especially a regular sports engine—so I ceased operations at 22,200rpm and 1.51hp (only just starting to level off).

The manufacturer claims 1.17hp at 15,000rpm (not necessarily the maximum), but they don't specify

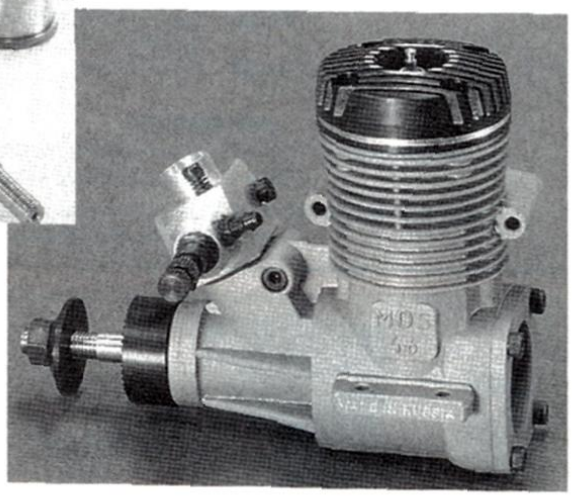
This new Russian engine is an eye-opener, and we're sure to hear more from this manufacturer.

MDS 46 ABC

MDS .46 Aero Sports R/C dB levels	Wind 3mph				
9 feet AMA/USA	Standard silencer 10x9 APC 11,100rpm	98	91	90	93
7 meters at BMFA/U.K.	Standard silencer 10x9 APC 11,100rpm	84	78	82	83

Engine: MDS .46 (7.4cc)
Equipment: standard silencer
Fuel: 5% nitro with methanol
Temperature: 37°
Humidity: 78%
Pressure: 992mb
Meter: Radio Shack type 33-2050 using GA601 calibrator set to NPL standards
Height: meter and engine set approximately 3 feet above concrete
Location: outdoors, next to farmland

dB meter



The high-quality crankshaft features a threaded nose produced by "grinding"! All the internal parts are of the same high standard.

their test conditions, so it's hard to relate their figures directly to those in this report.

• **Test 2. Standard silencer.** *Fuel and plug as in Test 1.* The supplied silencer is a solid 5-ounce unit with a 0.275-inch-diameter outlet (7mm).

Long, easy-to-fit bolts secure the unit to the crankcase from the boost-port side (a method that several other manufacturers should note). As the Sound Level chart shows, when operating at 11,000rpm, decibel levels are very near to UK and AMA requirements. Running at lower rpm should improve matters even further.

The usual restrictions imposed by backpressure silencer designs apply here: reduced torque and hp and a clear drop-off in these values when, at higher rpm, the silencer becomes increasingly choked with exhaust products that can't escape fast enough through the final small outlet hole (exhaust escape from the cylinder is restricted, and this prevents any meaningful increase in rpm); so, max hp was 1.10 at 17,780rpm.

For normal sports aircraft of average size, with a silencer, props such as 10x9, 10x7, 11x6 and 12x6 are appropriate.

SUMMARY

At the end of my tests, the engine's condition, compression and rotational freedom were still fine. This new Russian engine is an eye-opener, and we're sure to hear more from this manufacturer.

**Addresses are listed alphabetically in the Index of Manufacturers on page 184.*

MODEL AIRPLANE NEWS

FIELD & BENCH REVIEW

The nice lines and the vibrant color scheme make a good-looking model. The Windstar EP is a graceful flier and a good thermaller.

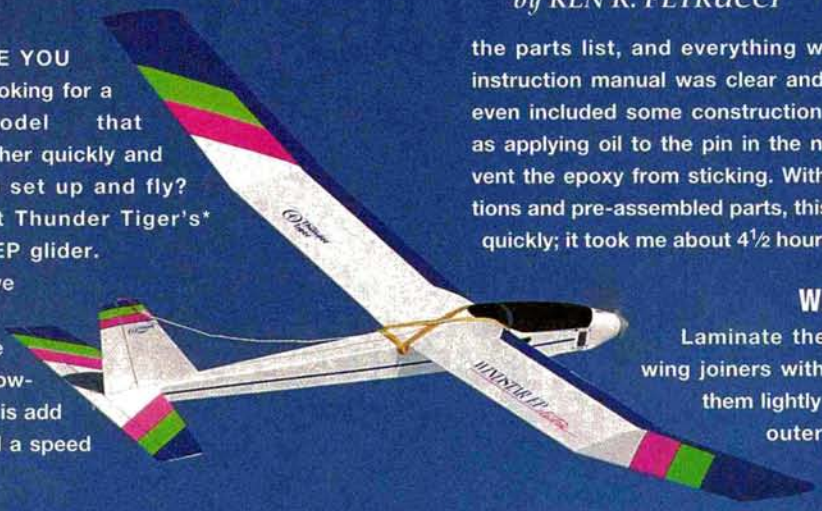
Thunder Tiger

Windstar EP

Electric polyhedral thermaller

by KEN R. PETRUCCI

ARE YOU looking for a model that goes together quickly and is easy to set up and fly? Check out Thunder Tiger's* Windstar EP glider. All you have to do to complete this ARF-powered glider is add a radio and a speed control.



PHOTOS BY WALTER SIVAS

THE KIT

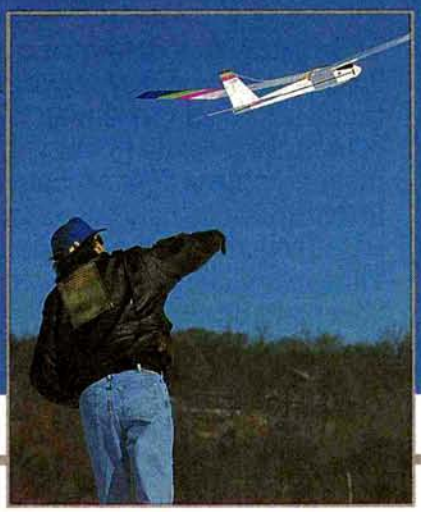
The picture of the Windstar on the box was impressive. Its white body was accented with hot pink, blue and lime-green bands; the canopy was black, and a blue stripe ran the length of the fuselage. I examined the parts and discovered that the ply and balsa parts weren't cracked and were of good quality. The die-cutting was good and needed very little sanding to clean up the edges.

ASSEMBLY

First, I read through the assembly instructions and made a checklist of all the tools and materials that I would need. Then I checked the parts against the parts list, and everything was included. The instruction manual was clear and easy to follow; it even included some construction techniques, such as applying oil to the pin in the nylon hinge to prevent the epoxy from sticking. With the easy instructions and pre-assembled parts, this kit went together quickly; it took me about 4½ hours to assemble.

WINGS

Laminate the inner and outer wing joiners with epoxy, and sand them lightly for a snug fit. The outer wing joiners are made of three layers of plywood, and the inner wing joiner is made of two layers of plywood and one piece of aluminum for added strength. Before gluing the wing joiners to the wing sections, trial-fit the assembly. With a four-piece, polyhedral wing alignment, accuracy is essential to good flight performance. The wing sections fit together nicely, and sanding was minimal. The covering graphics on the right outer wing section didn't line up exactly with the inner wing section, but the other sections lined up well and looked good.



The first launch on the flight-test day. A firm toss into the wind with the power on is one way to go with the hand-launch procedure.

SPECIFICATIONS

Model name: Windstar EP
Manufacturer: Thunder Tiger
Type: electric R/C sailplane
Wingspan: 77.3 in.
Wing area: 574 sq. in.
Weight: 54.75 oz.
Wing loading: 13.75 oz./sq. ft.
Length: 44.5 in.
Number of channels req'd: 3 (elevator, rudder, speed control)
Motor recommended: Mabuchi 540
Radio used: Cox Cobra Three
Prop used: Graupner folding (included)
Airfoil type: flat bottom
Wing washout: built-in
Battery: 7-cell, 8.4V or 6-cell, 7.2V 1000mAh SCR to 1700mAh SCR
Landing gear: skid plate
Speed control: Novak Arrow
List price: $150

Features: components are 90-percent assembled and completely covered; Mabuchi 540 motor included; complete hardware package; instruction manual.

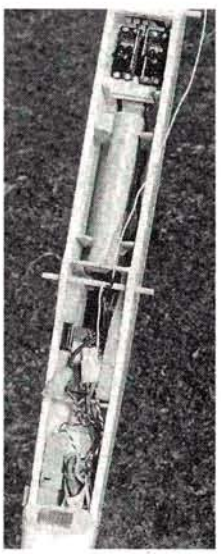
Comments: the Windstar EP is extremely easy to assemble, and it goes together quickly, which was great because I have a limited amount of time to devote to building. It flies well and is a good introductory R/C glider.

Hits
- Instruction manual is clear and concise.
- Ease of construction.
- Quality of pre-assembled and covered pieces.
- Quality of hardware package.

Misses
- Graphic lines on one wing panel didn't line up.

FUSELAGE

The main body of the fuselage comes pre-assembled, and the motor, the canopy, the cowl and the tail feathers have to be installed. I worked on the canopy first and took care not to over-cut the pieces. I trial-fit the pieces before gluing, and when the fit was good, I glued the canopy to its plywood base with CA. After some sanding, I was able to match the upper part of the canopy to the wing's curvature.



A shot of the radio and battery. There's plenty of room for the 2-channel system and the 6-cell pack.

Before mounting the motor, I read the instructions for the Novak* Arrow speed control. I'm glad I did because it came with three capacitors that needed to be soldered to the motor before the controller was installed. The motor-assembly installation went very smoothly. The next task was to prepare the preformed plastic cowl for installation. I used curved scissors to cut the mounting flange, an air scoop and a motor-shaft opening in the cowl. Then I sanded all rough edges and installed the cowl on the fuselage with four screws. Using three screws and two nuts, I was able to securely mount the Graupner* high-performance folding propeller on the drive shaft.

Proper installation of the rudder and elevator assemblies is another critical aspect of good flight performance. The tail feathers are pre-

FLIGHT PERFORMANCE

by ROGER POST JR.

Before the flight test, 1 3/4 ounces of lead were added to the nose, and some minor adjustments to the control throws were made.

• Takeoff and landing

I re-checked the control directions, advanced the throttle to full and tossed the glider into the wind. The 6-cell, 1500mAh battery pack provided enough power for a good rate of climb. I'm sure that a 6-cell, 1700mAh pack or a 7-cell, 1000mAh pack would provide a faster rate of climb. Tracking was straight ahead, and only a slight amount of up-trim was required.

After gliding for 7 minutes, it was time to land. With the power off, I pointed the glider into the wind, kept the wings level and gently flared before touchdown. To control the airspeed, I pitched the nose up to slow down and lowered the nose to speed up. I saved a little power for the landing, which was a good thing because I had to go around. A combination of the remaining power and pitch changes via the elevator allowed me to circle the glider and land it.

• Low-speed performance

At altitude, I cut the throttle and added some up-trim. Pointing the nose into the wind and slowly pulling back on the stick, I stalled the glider; it fell forward and started to fly again. I tried varying degrees of low-speed stalls and, the sharper the stall, the longer the forward dive needed to recover. Avoid this on the approach, especially if the plane is close to the ground, because it might fall too far forward and do a one-point landing, nose first. Under partial power, I had to add up-trim to sustain some altitude. The Windstar EP handled quite well during the low-speed test, but keep this in mind: *a polyhedral, 3-channel glider reacts slowly to control inputs.* Therefore, you must anticipate your next control input before it's needed.

• High-speed performance

It's not quite a ducted-fan, but it will move out when you dive to gain some airspeed. With the throttle setting on full, the climb into the wind was not too fast, but downwind flight built up some speed. Power-on stalls consisted of pulling the nose up until the break and letting the plane fall forward to regain flying speed.

• Aerobatics

To perform aerobatics with the Windstar EP, you'll need airspeed. Use a dive, and then a gentle pull on the stick for the start of a maneuver. To be completed, loops needed around a 40-degree dive angle. Rolls required more speed than the loops because the polyhedral, high-aspect-ratio wing doesn't like to roll over itself. Stall turns and wingovers required a dive angle similar to the loops, at which point you should pull back on the stick and, when the plane is vertical, kick it over with rudder input. You must anticipate the rudder input; otherwise, you'll lose all vertical speed, and the plane will perform a sharp stall. This stall could be turned into a lopsided loop, or the plane could be allowed to fall forward to regain flying speed. Combining power input with diving also helps to gain forward speed for aerobatics. For the loop, you can cut the power when it reaches the top. For the roll, you could cut the power when it's three-quarters of the way through the roll. For the stall turns and similar maneuvers, keep the power in until you kick the plane over with the rudder; then cut it. The Windstar will perform a spin but, obviously, it won't be a tight one.

The Windstar EP is relaxing to fly; just remember to anticipate the control inputs. When flying crosswind, the polyhedral wing might be picked up by the wind. Don't let this scare you; apply the necessary rudder correction, and the glider will recover. I recommend that you use maximum control throws because at some point during the flight, you'll need them.

TRAINING WITH THE WINDSTAR EP

by JEF RASKIN

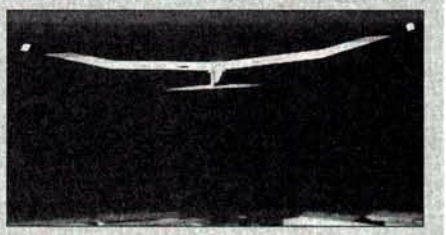
When our old trainer finally wore out, I looked around for an ARF kit I could get in the air by the next weekend. I noticed the Thunder Tiger Windstar EP—a 2-meter, electric-boosted sailplane.

Sailplane? Sure. Now that you can get 15-minute flights with no hassle, no waiting, no noise and no cleanup, they are ideal as trainers. Besides, polyhedral sailplanes tend to be the easiest models to fly. With three battery packs and a peak charger out at the field, you can fly all day, nonstop.

MODIFICATIONS

To help it survive, I made a few modifications. First, the model needed wheels. I chose an aluminum landing gear for simplicity and spongy 3-inch wheels to cope with our bumpy landing area. A few moments with anvil and hammer and the gear was re-bent to the width of the fuselage; not knowing what size prop would work best, I made it tall enough to allow for a 13-inch diameter windmill. The landing gear is positioned by two wooden pegs, protruding all of 1/16 inch, that fit into holes in the landing gear. I want the landing gear to pop off, not break the pins in a hard landing. The gear is held against the bottom of the fuselage by two rubber bands X'd across it.

The stock motor mount is a cantilevered aluminum clamp, shrouded by a thin, vacuum-formed plastic cowl. This is too fragile for training, so I laminated three pieces of ply and balsa to the nose and drilled out a hole for the prop shaft. For better duration, I switched to a geared motor (I could just as well have put a gear drive on the provided motor).



The Windstar takes off toward the Pacific and Hawaii. Aloha!

To hold the motor, I installed a balsa V-block in the fuselage and made a balsa-block canopy into which I cut another vee. Firmly rubber band the canopy onto the motor to make a strong, simple clamp. This method has proven itself repeatedly, even when the plane crashed nose first; the back of the prop dented the balsa nose layer, but the motor was completely undamaged, the shaft not even bent.

A lot of damage in crashes of electric models is caused by the heavy battery pack smashing forward, so I mounted the battery pack externally, which also ensures proper cooling.

In primary training, we don't fly any aerobatics, so I use only six no. 64 rubber bands instead of the recommended eight to hold the wing on. This helps prevent damage to the wing in hard landings. The model will drop a wingtip if it is stalled on the landing run, so be warned. A Master Airscrew* 12x10 folding prop not only flies well, but also prevents breakage.

Lastly, I added a tailwheel to keep the aft portion of the fuselage from being rubbed to death, and I replaced the delicate plastic wingtips with 1/4-inch balsa pieces sanded to the airfoil shape.

FLYING

The takeoff is straight ahead and, if the plane is trimmed properly, it will practically take off by itself. With no ailerons, crosswind operations are not recommended. The climb is brisk but not meteoric. With a 2:1 geared Astro* .05, I am getting 10-minute power runs, and 15- to 20-minute flights. Longer flights are possible with the Model Electronics* Turbo 10 GT motor and their 6:1 gearbox. A few thermals or some slope lift can extend the time aloft indefinitely.

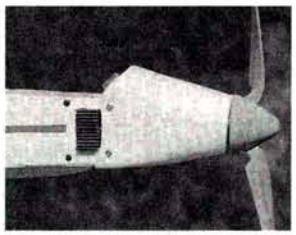
PHOTOS BY JEF RASKIN & AZA RASKIN

The landing gear, SR* battery pack and the mounting pegs on the fuselage prior to rubber-banding it all together. Note that the Sermos* connector will be pushed inside the model after the connection has been made. The battery will then cover the opening.

I get 10 takeoffs, circuits of the field and landings on a single charge of the SR 1800mAh batteries, or about a dozen touch-and-goes. A nice thing about a converted sailplane is that, with a bit of practice, thistle-soft, power-off landings can be had every time.

With performance like this, I'd say our new club trainer is going to be a success.

WINDSTAR EP



The heat sinks protrude through the fuselage side.

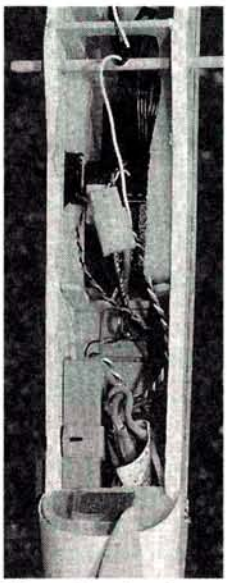
assembled and covered, and the hinge slots have been cut for quick assembly. As the epoxy cures, periodically check the alignment of the surfaces.

RADIO AND BALANCING

I used a Cox* Cobra Three radio and receiver with two Cox servos. The servos were slightly smaller than the servo tray, so I used two small plywood scraps from the canopy die-cut sheet and added them to the servo tray. This modification created the proper size opening.

The instructions that came with Novak's Arrow speed control indicated that cooling fins should be installed through the fuselage to maximize the airflow, so I installed the unit directly behind the motor. To make it work, I had to trim the mounting harness of the speed control, which I kept as far forward as possible to help balance the plane.

I centered a 6-cell, 7.2V, 1500mAh battery pack over the CG (2 1/2 inches behind the leading edge) but, later, I found that moving the battery all the way forward in its cradle was the best location.



The Novak Arrow speed-control is mounted on the fuselage side with the supplied mounting bracket. To keep the heat-sinks cool, I cut a hole in the side of the plane and let the heat-sink fins exit through this hole. The lead weight is under the folded prop.

I installed the receiver forward of the battery and used a small amount of wood glue to stick a foam-rubber cushion to the bottom of the fuselage under the canopy. Then I used Velcro®-brand fastener to attach the receiver to the foam rubber. The Velcro® enabled me to move the receiver forward and backward to help balance the plane. I tried a few locations but found that even with the battery and receiver all the way forward, additional weight was needed.

FINALE

The Windstar EP goes together quickly and looks great upon completion. Because the quality of the construction was very good, the kit went together without a hitch and made the building experience a pleasure. If you're looking for an electric glider, consider the Windstar EP; I'm sure you'll enjoy it.

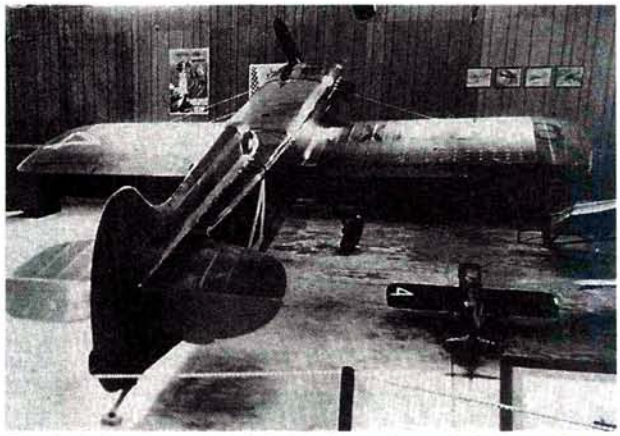
**Addresses are listed alphabetically in the Index of Manufacturers on page 184.*

About the author

Three years ago, Ken Petrucci decided that he and his 9-year-old son, Tyler, would enjoy building and flying model airplanes together. Since then, they have been regulars at the local FLYRC field and have reviewed two planes for Model Airplane News. Ken and Tyler live in Newtown, CT.

by BOB UNDERWOOD

MODEL WEIGHT AND WING LOADING



The full-size Bonzo, with Bob's 1/4-scale model alongside for comparison.

TWENTY-FIVE years ago, a bad dream (or evening meal!) prompted me to build a scale model of a 1930s racing plane (Steve Wittman's Bonzo) at 2½ inches to the foot. The result was a model that had a wingspan of under 50 inches and a chord of 14 inches, and it weighed 9½ pounds. It flew much like those made by our friend Guy; it had the sink rate of a brick, and it flitted about like a drunken hummingbird.

There once was a modeler named Guy,
Whose planes rarely happened to fly.
Their weight, it was said,
Was akin to pure lead.
Is it a wonder they never touched sky?

While watching it fly at the Nats at Glenview, a prominent modeler suggested that if I "built it bigger, I could build it lighter." As I considered his departing figure, I mused that something must be adrift in that portion of his anatomy above the shoulders. Then, a friend pointed out his meaning: a larger model would have a lower wing loading. When I returned home, I enlarged the plans to ¼ scale (3 inches = 1 foot) and built another plane. What a change in flight characteristics! I picked up many square inches of area and just a little overall weight because I could use an engine of the same size, and the radio and running gear were virtually identical. It flew great!

Bob Underwood (right) looks on as Steve Wittman, the designer of the full-size Bonzo racer, admires Bob's 1/4-scale Bonzo model. The photo was taken in 1971 at the EAA museum, Hales Corner, WI, where the full-size Bonzo is on display.

WHAT ABOUT WING LOADING?

What is an optimum weight for wing loading? That's a question I couldn't begin to discuss here for two reasons: I don't have the aerodynamic smarts to do so, and the vast array of models defies a simple answer. (We've all probably heard that scientific laws prove a bumblebee can't fly, but no one ever told the bee!) We now have models that fly quite nicely at wing loadings well beyond the accepted range of just a few years ago.

Yet we can't ignore wing loading and overall weight. We tend to grossly *overdesign*; this leads us to produce models capable of withstanding G-forces *way* beyond what they're ever likely to encounter. We do it by using spruce of the same thickness as if we were using balsa (it's stronger, we say); we double the thickness of doublers; we add another layer of fiberglass cloth, or extra resin or epoxy to fill the cloth, and on and on. The interesting thing is that often we haven't built a stronger or better model, but rather one that doesn't fly as well!

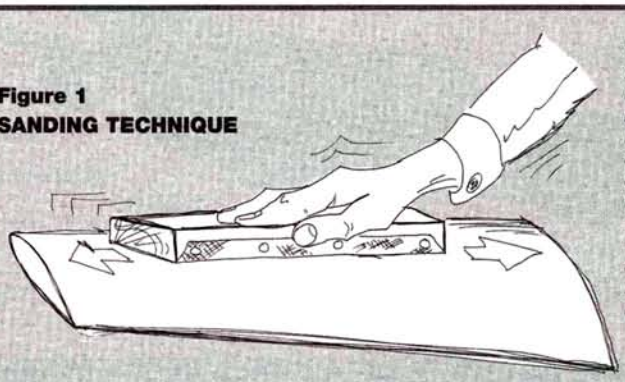
• **Look for weak links.** Sometimes, it's not a stronger or better model because we have weak links somewhere in the system—maybe all those stronger, heavier components joined to the "same old" linkage or connector. How often have you noted a brute of a model—well-built, designed to penetrate carbon steel, but controlled by puny servos or linkages that flex like mad? Or one that has a major component held on by a little old nylon screw?

Some years ago, I drew up plans for a model that had rearward, rotating retractable gear. I paid careful attention to the spar at the wing center section, as well as to other components of the built-up wing. Because it was a fully

SANDING HINTS

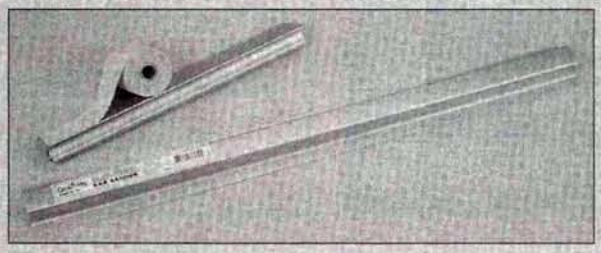
We all know the basic law of sanding: when you think you've finished, sand once more. The problem with sanding is that you do a lot of it when the model is nearly complete. The cherished design is there in "flesh" and formers, and it's hard not to rush the job. The other problem is that when you're working on a balsa or fiberglass framework, many of the imperfections just don't show up easily. But when you spray on primer or apply the plastic covering, every little place that you missed when sanding seems to carry a neon sign that announces, "You blew it!" Of course, the problem is compounded if the model is a dark color. White's easy; black's the pits!

Figure 1
SANDING TECHNIQUE



To sand surfaces flat and smooth, use a sanding block that's as long and as wide as possible. Using a short sanding block or, even worse, not using one, can actually accentuate undulations in the model's surface.

• **Fingertip test.** Here are some hints you might not have thought of. If the surface is sheeted, your fingertips are an excellent judge of consistent surface smoothness. Slowly and carefully, at a constant speed, move your fingertips along the wing, stab, etc., both spanwise and chordwise. Any unevenness in their surfaces will be evident, especially at the sanded primer stage. Close your eyes while performing this ritual. It doesn't hurt to block out other stimuli as well. (Turn off your workshop TV/VCR, which is showing "Judge Dredd"!)



A useful sanding tool is the Great Planes* Easy Touch Bar Sander. The self-adhesive sandpaper is available with different grit sizes.

• **Light your way.** Unfortunately, the fingertip test will not reveal tiny imperfections in unfilled fiberglass cloth or pit marks in gelcoat. So-o-o, you'll need to do the vision test as well. The lighting in many workshops, especially if it's fluorescent, is not conducive to seeing these little marks. To get a better view of a part, hold it so that it is dark behind you, and you look across the part toward the light source.

Open framework presents its own problems. Obviously, the unevenness of a sheeted surface is not a factor. With a wing, for example, it's very hard to tell whether all the ribs are even by just looking at them. We will assume that you carefully sheeted wing, I figured plenty of safety had been built in—until it dawned on me that 10 inches out on both wing panels, more than half the spanwise sheeting was, shall we say, "interrupted" by a gear strut and a wheel-well opening and that the lower spar also was not continuous! Hmm! One friend, obviously not well-versed in the physics of design, suggested that the break in the sheeting wouldn't be a problem because the slot for the strut was "only ¾-inches wide." Double hmm!

The moral of this lengthy discourse is that all aspects of the design must be carefully considered, step by step. Experience and common sense will play an important role in the design considerations. Bounce your design off your friends. The old "forest for the trees" concept comes into play, and so very often others will find your design faults.

• **Check the weight.** Although your choice of balsa grades can add significantly to a model's overall weight, more often, increased weight is the cumulative result of other items, especially if they have metal parts. On one of my recent models, the selection of wheels made a difference of 9 ounces of overall weight. Don't be afraid to shop around for lighter balsa or other components.

• **Analyze.** If you build strictly from kits, you may be tempted to suggest that you don't have to worry about the design. After all, the kit was designed by experts, right? If you're working with kits from established companies, you would generally be correct, but it still pays to analyze the design and materials. I remember a kit I built years ago (not scale) whose manufacturer emphasized that the elevator linkage had to be *strong* and slop-free; every bit of it was, from the elevator all the way to the servo. Then, the instructions showed a mounting method for the servo that was super flimsy.

Wittman D-12 "Bonzo" 1930s Thompson Trophy Racer Model Specs

(The full-size Bonzo has a wingspan of 17.16 feet and a chord of 5.5 feet.)

	2½ in. = 1 ft.	¼ scale
Span	42.9 in.	51.48 in.
Chord	13.75 in.	16.5 in.
Wing area	590 sq. in. (4 sq. ft.)	849 sq. in. (5.9 sq. ft.)
Weight	9.5 lb. (152 oz.)	10.5 lb. (168 oz.)
Loading	38 oz./sq. ft.	28.5 oz./sq. ft.

The actual wing area is somewhat less than these figures because of the rounded wingtips, but these numbers are close enough to show how wing loading is reduced if you go from 2½ inches = 1 foot to ¼ scale. Differences in flight characteristics occur because of Reynolds number factors.

used a long, flat sanding bar to dress down the ribs and leading and trailing edges and made certain that the sandpaper-covered bar has made contact with all ribs from tip to root. Now, recheck with a metal yardstick. Look for light between the yardstick and the rib edge as you s-l-o-w-l-y move it along the surface.

• **Sanding blocks.** Some modelers use a very short sanding block (or none at all!) when they sand sheeted surfaces. "None at all" can be a real problem if there are undulations in the surface, because just holding the sandpaper in your hand gives it a soft, flexible surface that not only doesn't necessarily even out the undulations, but it also can accentuate them! This problem will be compounded at glue joints. Use a sanding block that's as long and as wide as possible (see Figure 1). To smooth fillets, check out the semi-flexible to very flexible blocks sold at hardware stores. These are made of plastic foam and are coated on both sides, usually with two different grits. Even after the grit surface has been worn to a frazzle, you can still use it if you fold a piece of sandpaper around it.

Was that a weak link? Darn straight!

SEND YOUR IDEAS

I hope you understand that I have gleaned the ideas given in my columns from experience, but I know they are not the *only* way to accomplish the tasks at hand. Life has taught me that not only are there many ways to get where you're going, but also that you should never stop seeking another way. The items I've discussed may be old hat to you. To improve all our skills (mine included), send your tips and ideas for me to share in this column to "Scratch-Builders' Corner," *Model Airplane News,* 251 Danbury Rd., Wilton, CT 06897-3035. I will use them, acknowledge them and then "steal" them for my personal use when they are better than mine.

A personal note: to those who have expressed interest in both the Hiperbipe and Stormavik, I'm trying to provide plans and a construction article for both. Remember, patience is a virtue!

** Addresses are listed alphabetically in the Index of Manufacturers on page 184.*

MODEL AIRPLANE NEWS
HOW TO

Enhance performance with flaps

Flying with High-Lift Devices

by ANDY LENNON

Editor's note: in the May '96 issue of Model Airplane News, Andy Lennon discussed high-lift devices and drag reduction and why both are necessary. In this follow-up article, he puts them to work.

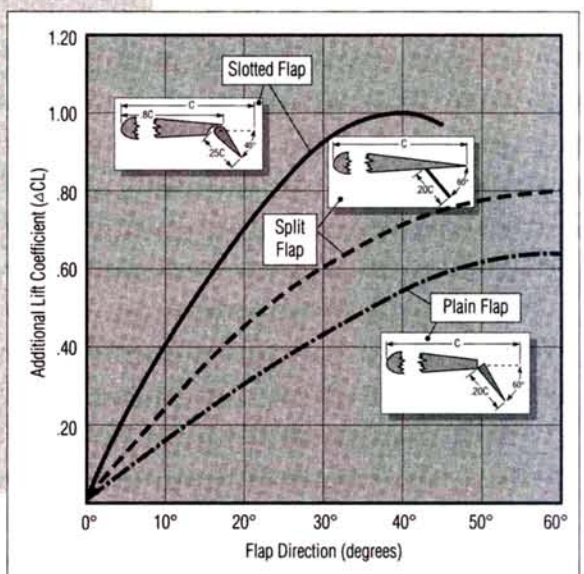


Figure 2. Additional flap lift at various deflections.

Windy-day landings, flaps up, were discussed in the May '96 issue. On a quiet day, wind-wise, the model may be slowed, flaps fully deployed, and nosed down as steeply as 45 degrees to the horizontal. The flap drag will limit the model's terminal velocity. There is no possibility of a stall and, at a reasonable height above the ground, the model is flared for a short-field landing. Landing flaps-up on such a day will be tricky; the glide is fast and flat, and overshooting the landing area is a real possibility. Maneuvers under power, flaps extended, can be almost incredibly tight, and the flaps themselves are sturdy enough to permit this treatment.

One advantage of the "30 percent of wing chord flaps with extended lip" is that there is very little pitch change when lowering the flaps. The Swift (reference 16) continued on its merry way on lowering full flaps, but it flew appreciably more slowly.

• **Centrifugal force** (reference 5). One concern with higher wing loadings, such as for model B (see May '96 issue), is that in a tight turn or sharp pull-up, centrifugal force plus the model's weight could exceed the wing's maximum lifting capacity. This could result in a dangerous, high-speed stall, particularly when pulling out of a steep dive at a low altitude. Assuming a turning radius of 60 feet (120-foot diameter), the following tabulates the G-forces involved compared with model B's maximum lift capacity, also in G, at various speeds.

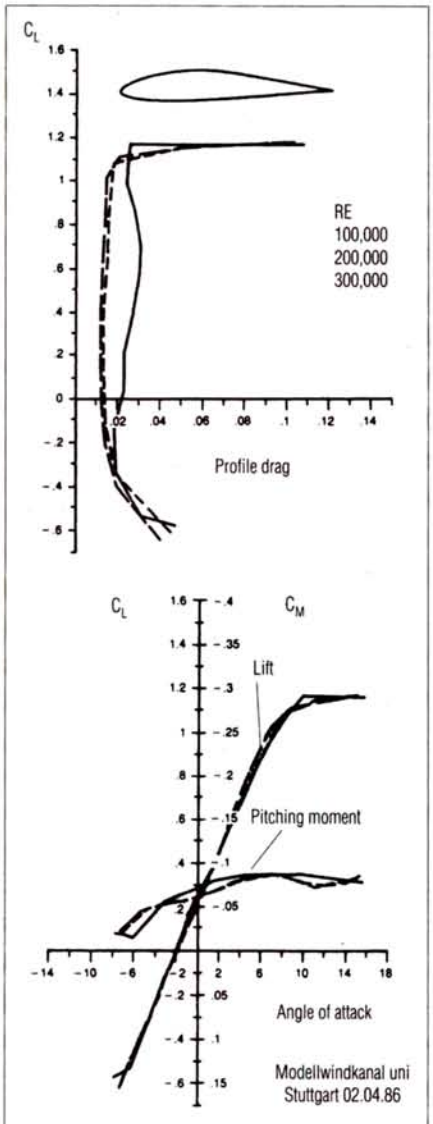


Figure 1. E197 airfoil chart.

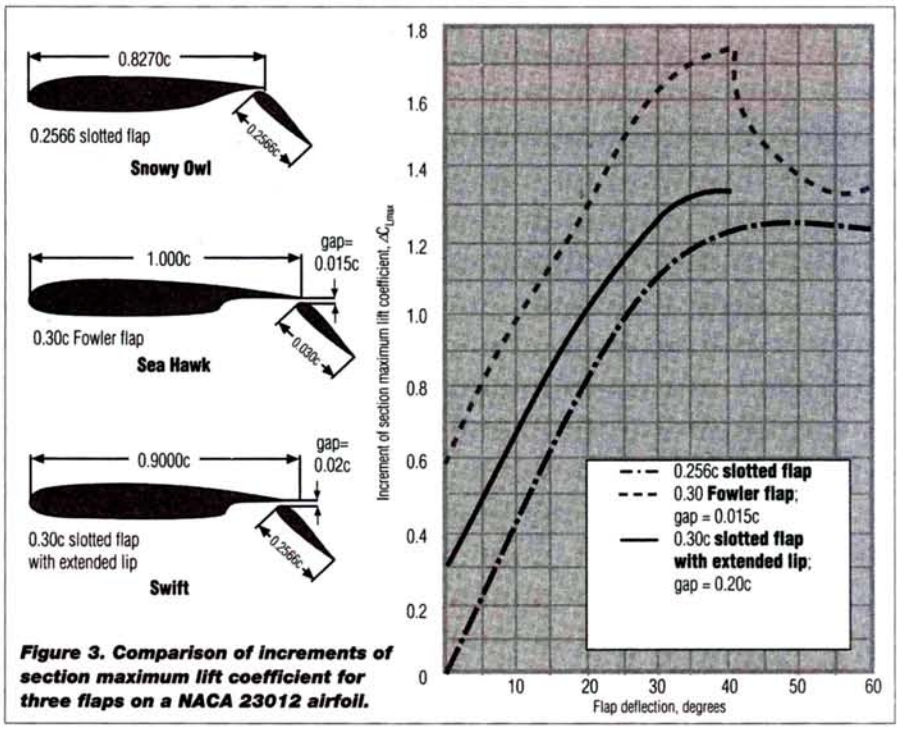


Figure 3. Comparison of increments of section maximum lift coefficient for three flaps on a NACA 23012 airfoil.

Speed (mph)	Wt. + cent.* load (G)	Wing max. lift (G)
60	5.00	6.80
70	6.45	9.25
80	8.11	12.00
90	10.00	15.30
100	12.12	18.90

*centrifugal

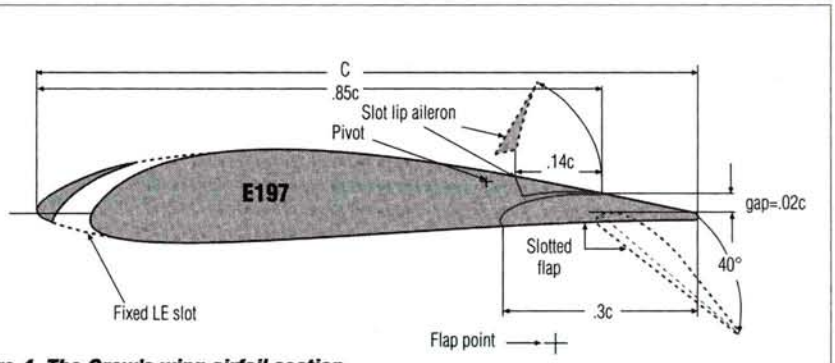


Figure 4. The Crow's wing airfoil section.

For model B, lift exceeds load at all speeds. Note the loads the model's structure must sustain at higher speeds. In a tight turn at 90mph, the load is 880 ounces, or a surprising 55 pounds.

• Wing trailing-edge high-lift devices. Figure 2 (from reference 2) and Figure 3 describe and show the additional lift provided by five types of flap: plain, split, slotted, slotted with extended lips and Fowler.

The most practical type, giving the optimum additional lift with lowest added drag, is the 30 percent of chord slotted flap with extended lip. These are easily operated by one standard servo; they're rugged and very effective. Because of their low drag at 20 degrees extension, they may be used for takeoff to advantage. Figure 4 illustrates the flap design for the Crow's wing. The only disadvantage is the longer streamlined arms from flap to pivot point needed to provide the increased backward movement required. (The additional lift provided by various forms of flaps, alone and combined with leading-edge fixed slots, was illustrated in Figure 3 of "High-Lift Devices and Drag Reduc-tion" in the May '96 issue.) Though the Fowler flap provides greater lift, its backward and downward motion demands complex pivoting arms (reference 15) or other mechanisms and powerful servos. Note that in Figure 3, the incremental lift coefficients are for full scale; in Figure 2, they are reduced by scale effect.

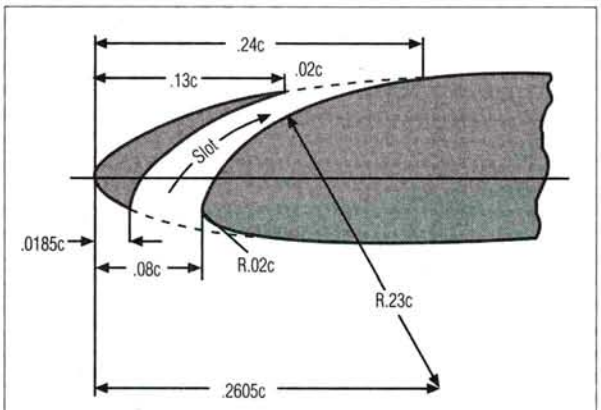


Figure 5. Geometry of the fixed leading-edge slot.

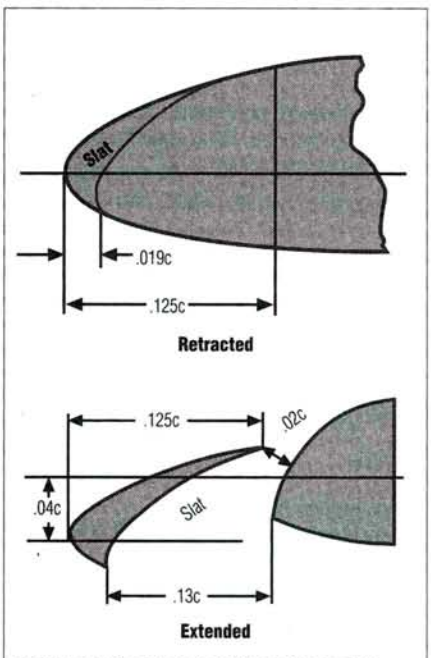


Figure 6. Geometry of the retractable leading-edge slat.

• Wing leading-edge high-lift devices: leading-edge slots. Figure 5 illustrates fixed leading-edge slots; Figure 6, retractable leading-edge slats. Figure 7 shows the benefit of fixed leading-edge slots: an increase in C_L max of 0.4 and a delay in stall to a 9-degree higher angle of attack, with only a small drag increase.

The retractable versions are self-opening at higher angles of attack, but they demand smoothly operating, non-jamming mechanisms and should be linked so that the slats of both wing panels extend simultaneously for obvious reasons. They may also be servo-operated.

To this author, the added complexity of the retractable slat is not justified by its benefits. The Crow has full-span, fixed leading-edge slots, as shown in Figure 4.

• NASA leading-edge droop (reference 1). As shown in Figure 8, these delay the stall by about 8 degrees; they provide extra lift at higher angles of attack; and they have low drag. Used as shown for 38 percent of the semi-span, ahead of the ailerons, they greatly improve aileron control effectiveness at high angles of attack. The "droop" was used on the Swift (reference 16) to advantage.

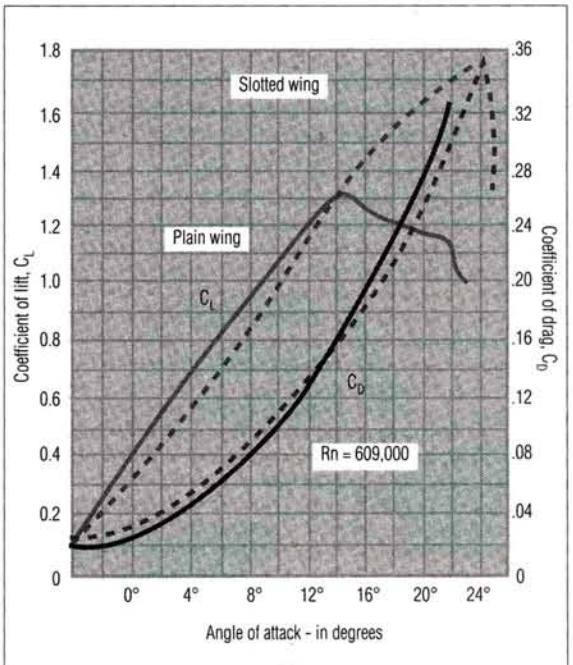


Figure 7. The benefits of the fixed leading-edge slot.

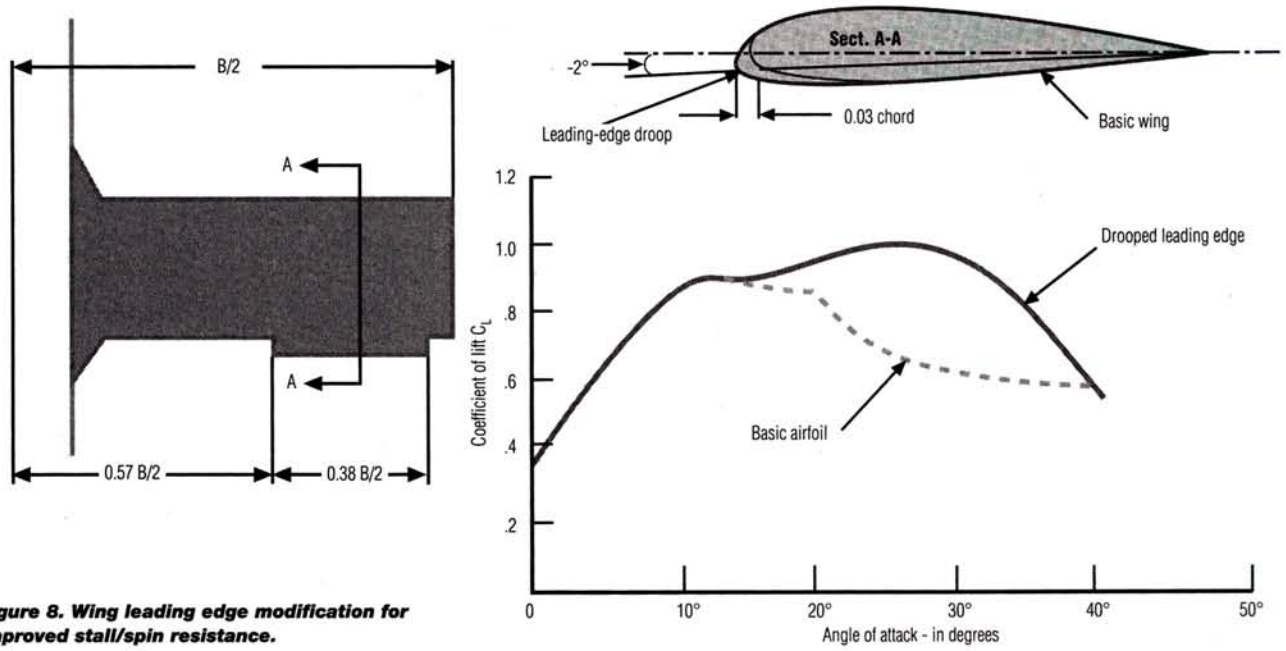


Figure 8. Wing leading edge modification for improved stall/spin resistance.

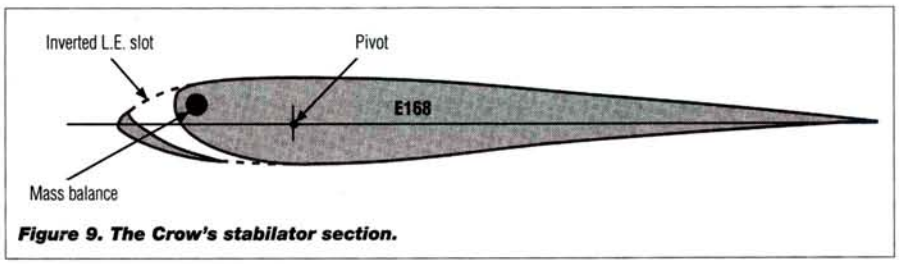


Figure 9. The Crow's stabilator section.

• **Horizontal tail leading-edge slots.** To obtain the high angles of attack (before the stall) of the wings with leading-edge slots and slotted flaps, a powerful downforce on the horizontal tail is needed to raise the model's nose. The author's Crane (reference 13) needed inverted leading-edge slots on its horizontal stabilator to achieve this attitude. Similarly, the Crow STOL model's horizontal stabilator is equipped with inverted leading-edge slots as shown in Figure 9.

• **Slot lip ailerons.** Illustrated in Figures 4 and 10, these replace normal ailerons when full-span flaps are used. On both the Crane (reference 13) and the Crow (see Figure 5 in the May issue), these have proven to be very effective, and they work inverted. At any one time, only one works—that on the inside of the turn; the opposite one lies flat. The raised aileron reduces lift and induces into-the-turn yaw. Both are lightly spring loaded to hold them down when they aren't being actuated. With flaps extended, they are even more effective. Raised, the slot effect over the flap is destroyed (Figure 10), reducing flap lift and adding into-the-turn drag. They provide crisp roll control at lower speeds of flap-extended flight—when most needed! The dimensions of these slot lip ailerons on the Crow were: width—0.15 percent chord; length—0.6 percent of semi-span.

• **Landing-gear design.** Landing-gear design for models with high-lift devices is thoroughly discussed in reference 10. The "tail angle" (also called the "tip-back

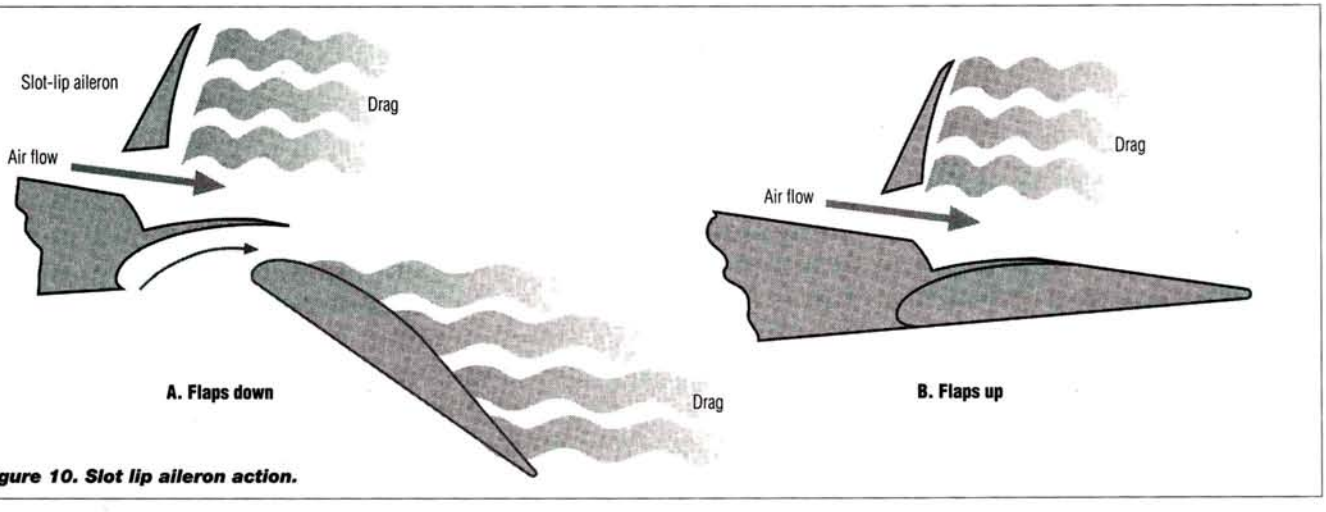


Figure 10. Slot lip aileron action.

References—Model Airplane News articles:

1. NASA Safewing—June 1990.
2. Design for Flaps—October and November, 1991.
3. Reducing Drag—January, February and March, 1992.
4. Airfoil Selection—May and June, 1992.
5. Wing-Loading Design—August, 1992.
6. Stressed-Skin Design—September and October, 1992.
7. Propeller Selection—November and December, 1992.
8. Wing Design—January, February and March, 1993.
9. The Balancing Act—May, 1993.
10. Landing-Gear Design—March and June, 1994.
11. Speed Estimating—February, 1994.
12. Ducted-Cowl Design—August and September, 1994.

Model Airplane News construction articles:

13. Crane—March and April, 1983.
14. Gull—July, 1984.
15. Sea Hawk—October, 1992.
16. Swift—September, 1993.
17. Dove—November, 1994.

angle") must be large enough to permit the model to land at very close to its stall angle of attack and its slowest speed.

• **Control unit.** Flap operation requires an extra servo, which may be operated by the retract switch on a 5-channel (or more) radio, but this provides only full-up or full-down flap positions—no in-between! An auxiliary channel is desirable, controlled either by a three-position snap switch that provides full-up, 20 degrees down and 40 degrees down-flap positions; or a proportional slide switch that permits a choice of any flap position from full-up to full-down.

A TRIBUTE

Dick Murray and Ken Starkey—two friends and fellow club members—have test-flown each of this author's new designs. Both are pilots of consummate skills; and both offered valuable, constructive comments on the flight characteristics of each model. For lending me their skills and for their friendship, I am deeply grateful. Do try high-lift devices and drag reduction. Models of this type are highly versatile, and flying them is pure fun—well worth the extra effort their design and construction entails. Above all, they are sleek and beautiful.

MODEL AIRPLANE NEWS

FIELD & BENCH REVIEW

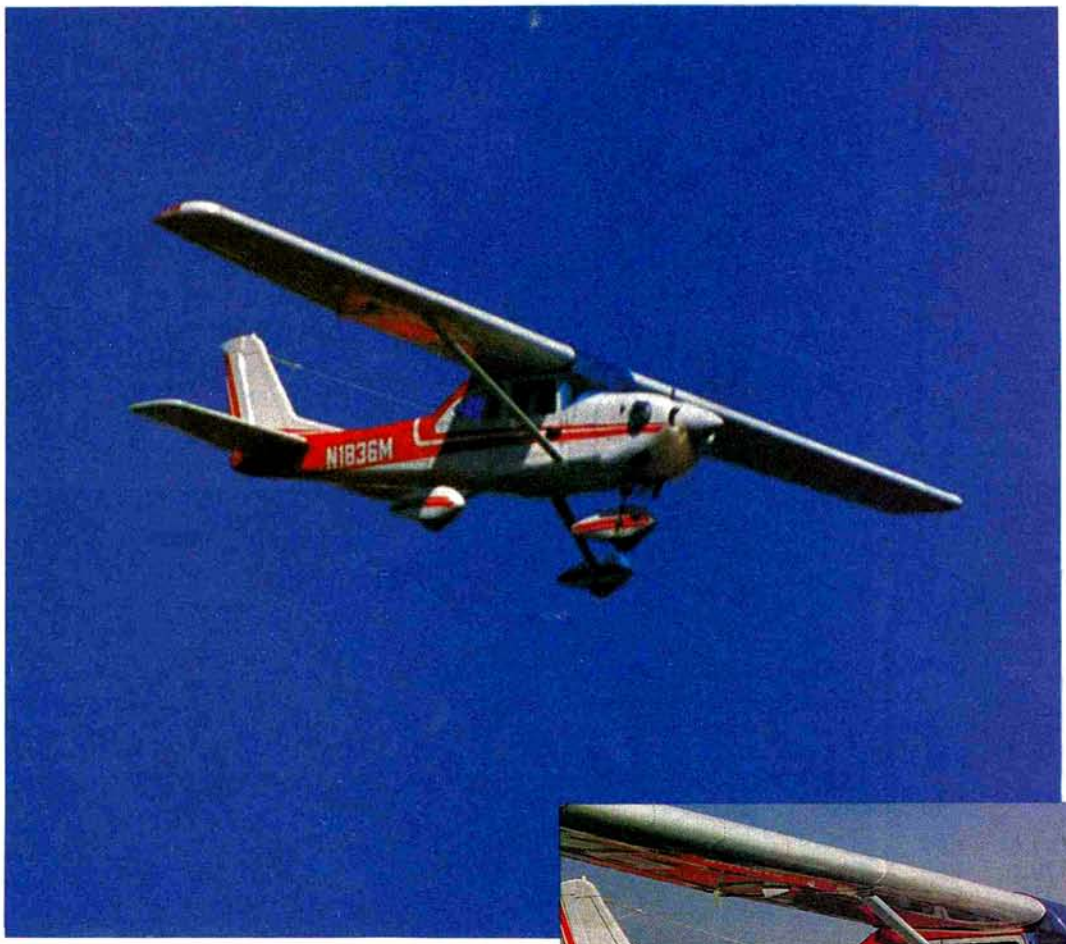
by CRAIG TRACHTEN

An ARF Skylane for the Sunday Flier

GLOBAL EZ LINE Cessna 182

MY FIRST impression of Global Hobby Distributors* EZ Line Cessna 182 ARF was *wow,* what a gorgeous kit! I must have unpacked, inspected and repacked the kit a half-dozen times before I started building. Each time, I was more impressed with the construction, the fit of the parts and the finish of the kit, and I couldn't wait to build it. I thought that if this kit flies as well as it looks, it would be a keeper!

When I build an ARF for a review, I assume that the reader knows nothing about building and will rely on the quality of the instruction manual for success. At first, the instruction manual for this kit seemed easy to follow and logically organized, but I discovered that it falls a bit short. The servo-tray construction and some of the pushrod installation instructions could be clearer, and some of the photos or drawings for these installations could be lighter or shown from a different angle. Also, there's no reference to the size of the bolts, nuts and screws that are used. These are minor problems, but they provide a challenge to the builder.



Sitting on the tarmac of Bluebird Aviation Corp. at the Danbury, CT, airport, the Cessna 182 awaits the pilot and his family. It's a powerful four-seater with a good range—one of the main reasons why the full-size Cessna 182 is so popular.

CONSTRUCTION

• **Wing.** Once I figured out the orientation of the bellcrank-mounting plates and aileron/flap servo tray, installation was a breeze. The plywood pieces for the sub-ribs and dihedral brace were well-cut and needed little or no sanding. Before gluing the two sub-rib pieces in place, study the picture for their correct orientation. I did sand a bit off the height of the dihedral brace. It fit so well before that all the epoxy would have been squeezed out during installation.

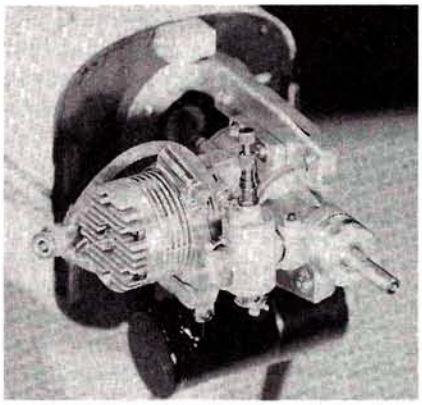
To build the rest of the wing, I followed the instructions, except for the following modification. To give more support for the front hold-down area, I added two, 3/8-inch-diameter dowels to the wing hold-down assembly, spacing them evenly between the center support and outside edge of the front brace (see photo).

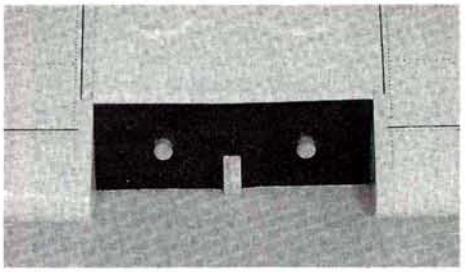
• **Empennage.** Mounting the tail feathers on the fuselage is easy; just make sure that you trial-fit the pieces before you glue them into place. Pay particular attention to the rudder torque-rod-

bearing installation. This rod should have free movement with absolutely no binding, and it should be centered on the hinge line. If this step is done correctly now, it will make the rudder linkage setup go smoothly and will allow equal deflection of the rudder from side to side.

• **Radio/interior.** Radio installation is basically the same as in most ARFs. A Futaba* 6VA Skysport with five S148s was the radio of choice. You have to remove two cross-braces from the center bulkhead, and then the ply servo tray fits snugly into place. The receiver was placed just behind the servo tray on the landing-gear block, and the on-board battery pack was placed up front under the fuel tank. The interior tray is made of lite-ply, and the two plastic floor pieces, with the seats attached, are attached to the tray with screws. After the interior had been put into place, I installed a Du-Bro* on/off switch with a charging jack.

• **Engine/balance.** A Magnum* XL .61A was my choice of engines for this aircraft. I've heard good things about Magnum engines, and this opportunity gave me a chance to find out for myself. The finish on the casting and head was impressive. The carburetor, which must be installed, is top quality and is easy to install and adjust. Setup and break-in was a pleasure and resulted in excellent performance. Engine installation is simple and is adequately covered in the manual. To maintain a scale look, I used a Davis Model Products* Pitts-style in-cowl muffler. To allow a proper fit when the muffler was installed, an additional slot had to be cut in the engine-head side of the cowl. To achieve the proper CG, I had to add 2 ounces of weight to the nose.





Left: the Magnum XL .61A with the Davis Model Products Pitts-style muffler in place. This combination, along with an APC 11x7 propeller, provided a reading of 87dB at 9 feet and 84dB at 15 feet with a static rpm of 11,700. A Du-Bro three-way filler valve was used as well.

Above: to add security to the front-attachment point of the wing, two, 3/8-inch dowels were added. Holes were then drilled into the top of the forward cabin former to accept these dowels.

SPECIFICATIONS

Manufacturer: Global Hobby

Model name: EZ Cessna 182

Type: Sport-scale .60 size ARF

Length: 58 in.

Wingspan: 72 in.

Wing area: 725 sq. in.

Wing loading: 28.23 oz./sq. ft.

Weight: 8 lb., 14 oz.

Engine loading req'd: .60 to .65 2-stroke

Engine used: Magnum XL .61A

Props: Master Airscrew 12x6 wood and APC 11x7

Muffler: Davis Model Products Pitts-style in-cowl

No. of channels req'd: 5 (throttle, elevator, rudder, aileron, flaps).

Radio used: Futaba Skysport 6VA

Fuel: Omega 15% nitro

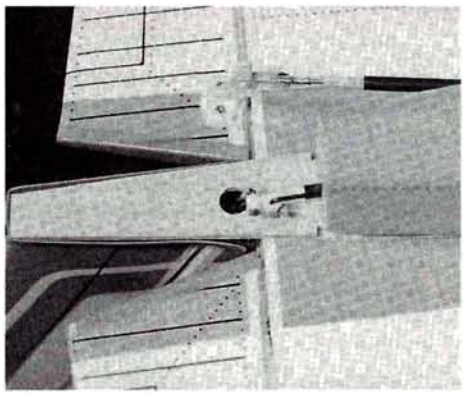
List price: $399.95

Features: pre-built and factory-covered; all hardware included; fully functional flaps; interior floor and seats; flush-mounted tinted windows.

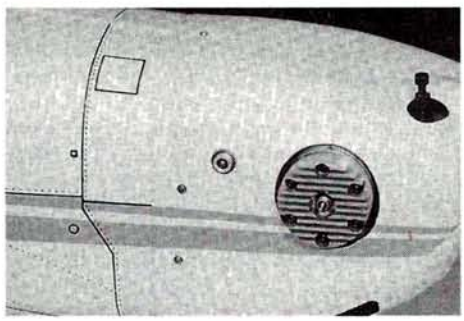
Comments: in spite of some minor problems with the manual, building this kit was enjoyable. The quality of the parts and their construction and the finishing detail are outstanding. I enjoyed the challenge of putting this plane together; I recommend it to anyone who has some building experience.

Hits
- Pre-built parts are well-made.
- Excellent finish.
- Great flier.

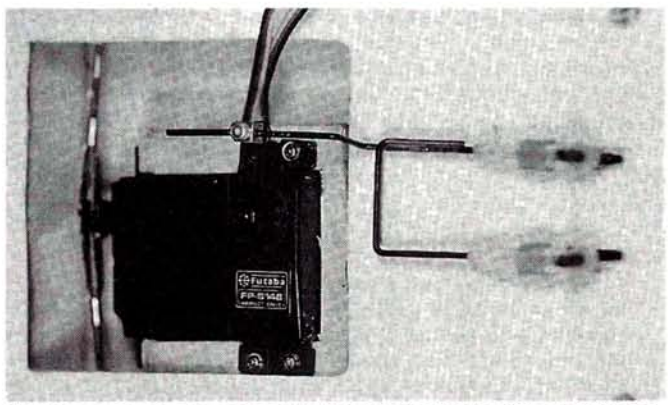
Misses
- The manual and some of the written instructions are a little vague; some of the photos and drawings would be more helpful if they were shown from different angles.



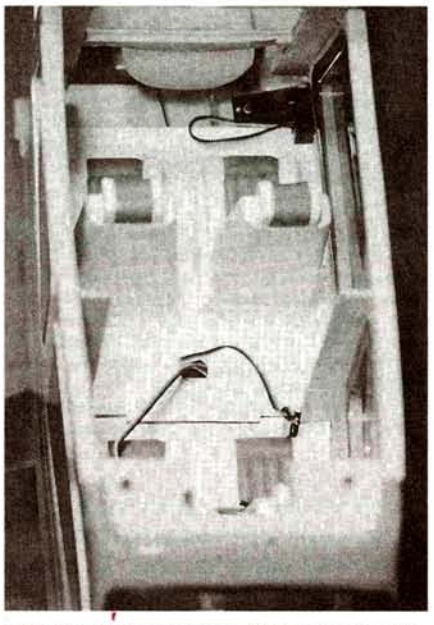
To attach the rudder-control rod to the torque-bearing-rod clevis, put an L-bend on the rod end and secure it with a wheel collar.



You can't see it in the picture, but I split the cowl lengthwise, right underneath the thin cowl stripe. This split makes it easier to take the cowl off and put it back on. To accommodate the muffler, I also had to make a hole in the bottom right side of the cowl.



The flap pushrod was made with the supplied parts, but a Du-Bro EZ connector was used in place of the standard Z-bend method.



The interior is in two pieces. A hole was drilled through the rear of the front half of the floor, and the aileron and flap-servo leads were passed through this hole. After the interior had been completed, a Du-Bro on/off switch with a charging jack was installed.

• **Pushrod installations.** The picture in this article will give you a clearer idea as to how the pushrod is connected to the rudder-torque-rod horn. Just make an L-bend and hold it in place with a wheel collar. The nose-gear pushrod is enclosed in a plastic housing; make sure you support the housing along its route. This method will provide a stiffer pushrod setup for the nose-gear linkage. The flap-installation picture in the manual is a little too dark to see the linkage clearly. To help clear things up, I've included a picture of how I set it up. The elevator, aileron and throttle linkages are easy to install; just be sure that there's no binding and that the movement of the control surfaces is free when the linkage is detached from the servo arm.

FINAL THOUGHTS

Because the manual was a little vague in some places, I had to use a slightly different approach to build this plane. I was extremely pleased, however, with the finished product. If you have some building experience and are in the market for a good-looking, sport-scale aircraft, there is no reason not to choose this Global EZ Cessna 182.

**Addresses are listed alphabetically in the Index of Manufacturers on page 184.*

About the author

For the past four years, Craig has been associated with this great hobby. During this time, he has built approximately 50 ARFs. He's the owner/operator of a Hobby-Town USA in New Milford, CT. Besides the planes, he builds and runs R/C cars and boats and is good at crashing R/C helicopters.

by ROGER POST JR.

FLIGHT PERFORMANCE

With the Magnum XL .61A set, it was time for the taxi test. The nose gear flexed too much; to correct this, support the pushrod housing inside the plane. Also, make sure that the nuts that hold the axles on the landing gear are tight.

• Takeoff and landing

With these corrections made, it was time to fly. If you have a paved runway, the height of the nose gear should be fine. We used a bumpy grass strip and recommend that the nose gear be extended to allow the nose of the plane to sit higher.

For takeoff, full up-elevator was held during the first part of the roll; this was gradually relaxed as the plane gathered speed and left the ground. A little right rudder kept the plane tracking straight. Because of its weight, the Cessna used about 100 feet of runway for takeoff.

The first flight was in windy conditions, and the Cessna cut through the wind with no problem. The Magnum engine has plenty of power to haul this plane around, and the recommended control throws are more than adequate.

When landing the Cessna, gradually reduce the throttle and lower the flaps in the downwind leg. To maintain sufficient airspeed, keep the nose pointed slightly downward on the final approach. The elevator has plenty of authority, so go easy on the input when flaring for touchdown. The bumpy field made the nose gear turn a little, and the plane flipped over. No damage was done, but even after a gentle touchdown, further inspection revealed a loose gear-mount plate. Check this glue joint before you go to the field.

• Low-speed performance

Model Airplane News "Simple Programming" columnist Dave Baron flew the second flight and found the power-off stall required quite a bit of up-elevator deflection. This input didn't allow the nose to come up as it should in the stall; Dave felt the plane was a little nose-heavy and that the CG could be moved back by ½ inch. After the second flight, Craig told us that to get the plane to balance on the recommended CG, he added a 2-ounce Harry Higley* hub. Because the plane showed no sign of tail heaviness, this hub will be removed for future flights, and we'll fly the plane with the CG farther aft. During the low-speed test, all the controls remained effective, but we noticed the rudder fluttered from side to side. The tube inside the fuselage that houses the rudder-pushrod needs better support. The rudder was effective during the low-speed test, but without better pushrod support, this fluttering will continue. If you plan to fly the Cessna at scale-like speeds, you're in luck because the plane handles this speed well.

• High-speed performance

With the Magnum at full throttle, this plane *moves*! We used a 12x6 for the first flight and an 11x7 for the second; both props turned in good performances. The power-on stall proved to be straight ahead, with no tendency to fall off to either side. To recover from the stall, you need only to relax the elevator input to get the model flying again. The Cessna grooved very well in fast forward flight and needed no trim input corrections. Air rushing over the tail surfaces damped any rudder flutter.

• Aerobatics

There is plenty of elevator and power for loops and inverted flight, and the plane rolls well in either direction. Dave compared the roll rate to that of a good-flying, shoulder-wing plane. Spins were easy to accomplish, but the plane would not tumble for Lomcevaks. Removing the Higley hub and rebalancing the plane should allow it to tumble. Full-throttle entry was used for knife-edge, and the Cessna needed some aileron input held in so that the opposite rudder would not roll it back to level.

Dave and I both feel that the Cessna is a good-flying plane; if the CG is moved back ½ inch and the pushrods are properly supported, the plane will be even better. Try the recommendations mentioned, and you'll have a plane that you won't want to stop flying.

ACE R/C INC.

Servo Master & Mix Master

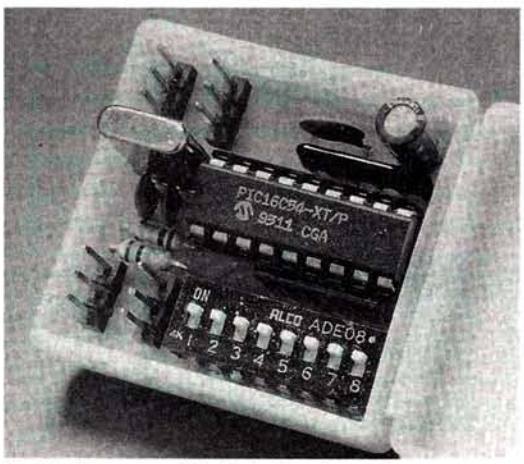
by GERRY YARRISH

MODEL AIRPLANE NEWS PRODUCT REVIEW

Ace R/C's ServoMaster and MixMaster give modelers who don't have a computer radio quick and easy mixing capabilities.

IT SEEMS that everyone at the flying field now has one of those super-duper computerized, do-everything radios. Are you feeling left out because you don't? Should you buy one? Well, computer radios can do some very impressive things, but their cost may not be for everyone.

Let's say you don't have a computer radio, but you do want to build and fly a model that requires some sort of channel mixing (this is what computer radios do best). For example, you might fly a V-tail Beechcraft Bonanza whose elevator and rudder must work together; or perhaps you want to fly a delta-wing design in which aileron and elevator must be mixed if it's to fly properly; or you need coupled aileron and rudder mixing (CAR).



Inside the case of both devices is a microprocessor chip and a bank of eight dip switches.

Mechanical servo sliders and other linkage-driven mixture devices do work, but they're complicated. Now there's a better way to mix two servos without a computer radio; Ace R/C* offers two new microprocessor-based mixing devices—the MixMaster and the ServoMaster. Here's a look at both.

Both devices are approximately 1½ inches square and ¾ inch thick and each contains a microprocessor and a bank of eight dip switches and comes with four three-pin Molex connectors and 12 crimp-on pins. It takes about 10 minutes to convert your servos to the Molex connectors and to

SPECIFICATIONS

Product: Ace R/C MixMaster—add-on channel-mixing module

Part no.: 26K10-2

Price: $39.95

Features

- Hooked up between the receiver and two servos, it will electronically mix any two channels.
- Eight dip switches provide numerous preprogrammed settings that accommodate all commonly used mix applications, such as flaperons, elevons, V-tail and coupled aileron and rudder mixing.
- Provides unidirectional and bi-directional mixing.
- Servo throws and mix ratios are adjustable.
- Comes with four Molex three-pin connectors and 12 crimp-on pins.

Product: Ace R/C ServoMaster—multipurpose servo-control module

Part no.: 26K30-2

Price: $39.95

Features

- Hooked up between a receiver and one or two servos, it will electronically control servo speed, direction and sequencing.
- Offers three servo-speed transit times—16, 8 and 4 seconds.
- Used with two servos, it acts as a landing-gear-door sequencer with two door-position settings (up and down).
- With built-in signal filtering for long leads, it can be used as a Y-connection to connect two servos to one channel.
- Eight dip switches provide numerous preprogrammed settings for easy control setup.
- Comes with four Molex three-pin connectors and 12 crimp-on pins.

Hits (both units)

- Size (small).
- Can be set up quickly.
- Easy to use.

Misses

- To function properly, the crimp-on wire pins for the Molex connectors must be attached very carefully (soldering would ensure a more secure attachment).

make two receiver lead wires. Once converted, simply plug the servos into the device and plug the device into the receiver.

Depending on which device you use, you can control the percentage of servo mixing or change their direction, sequencing and speed just by turning certain dip switches on or off.

MIXMASTER

This mixes two channels, either bi-directionally (both channels are equally mixed with each other) or unidirectionally (one channel is mixed with the other, but remains independent and is not affected by it).

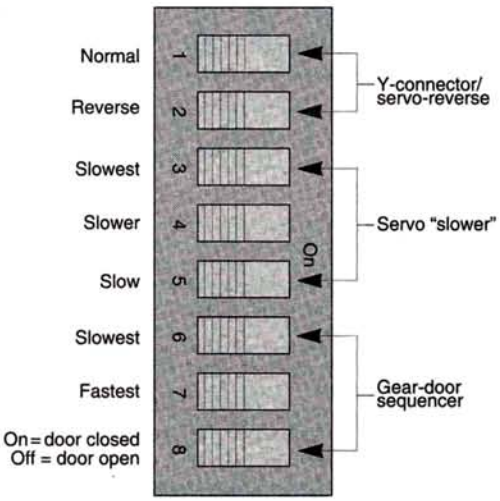
• **Bi-directional mixing** (Figure 1). Use this for flaperons (flaps and ailerons), elevons (ailerons and elevator), or V-tail function (rudder and elevator). These types of mixes are accomplished simply by plugging the two servo leads into the MixMaster's "Out" ports and plugging the two receiver leads into the "In" ports. To control the amount of servo throw, you turn on one of the first three dip switches; switch 1 gives full servo throw; no. 2 gives ½ throw; no. 3 gives ¾ throw.

The MixMaster automatically controls the servos so that when the two channels are mixed, neither servo will move farther than its 100-percent limit. There's no danger that you'll damage your servos by driving them past this maximum travel point.

• **Unidirectional mixing.** Use this for CAR, elevator and flap coupling, elevator compensation with flap deployment and, in helis, tail-rotor compensation with throttle advance. To use these types of mixes, you must make a Y-connection lead that connects the receiver to the MixMaster's "In" port and to one of the servos. The other servo in the setup is connected to the MixMaster's "Out" port. A separate receiver-to-mixer lead connects the receiver to the other "In" port. Depending on the setup, you now have a master channel that's mixed with a slave channel but is not affected when the slave-channel servo is commanded to move.

Detailed diagrams in the instructions make this all very clear and easy to understand. Dip switches 4 through 8 control the percentage mix between the slave and master channels. Two mix scenarios are shown in the instructions: "A"—mixing affects the slave channel from 10 to 50 percent; "B"—mixing affects the slave channel from 50 to 90 percent. Both scenarios allow the slave servo to retain full throw.

Figure 3. Dip-switch setting.



SERVOMASTER

The ServoMaster and the MixMaster look similar; both have the large bank of eight dip switches, but the ServoMaster is used with only one receiver output channel, and it splits the signal into two outputs to drive two servos.

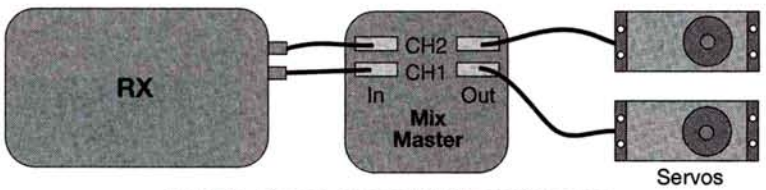
The ServoMaster can be used as a servo-reverser (to drive one servo), a Y-signal splitter (to drive two servos), and as a retract-gear-door sequencer. The device can also control servo speed—great for slowing down landing gear and flap deployment. Figure 3 shows the dip switches that control these functions. Switch 1 is for normal servo throw; no. 2 is for reverse throw; nos. 3, 4 and 5 adjust the slow servo speeds (16, 8 and 4 seconds of total travel time, respectively). Switches 6, 7 and 8 are used for gear-door sequencing and to adjust the doors' speed and position when the gear is in the down position. Again, the instructions make this very easy to understand. Depending on the dip switches' positions, you can have fast or slow P-51 Mustang-type gear-door sequencing (doors close again when the gear is in the down position), or P-47 Thunderbolt type (gear doors remain open when the gear is in the down position).

Used as a Y-splitter, the device can drive two servos—good for elevator, ailerons and flaps in giant-scale models. When used with longer servo leads, the ServoMaster will also work as a signal buffer to prevent the receiver from picking up interference.

Always be sure to turn off your radio before you move any of the dip switches, and as you do with your receiver, you should wrap it with foam to protect it from vibration. To control scale functions such as retracts or flaps, or for mixing control functions for specialized model setups, Ace R/C's MixMaster and ServoMaster offer easy setup and use. Give 'em a try.

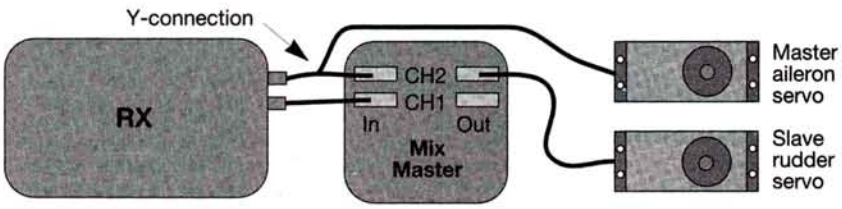
**Addresses are listed alphabetically in the Index of Manufacturers on page 184.*

Figure 1. Bi-directional hookup.



Example of uses: elevons, V-tails and flaperons.
The channels are equally mixed with each other.

Figure 2. Unidirectional hookup.



Master servo affects the slave servo, but the slave does not affect the master.
Slave retains full throw.

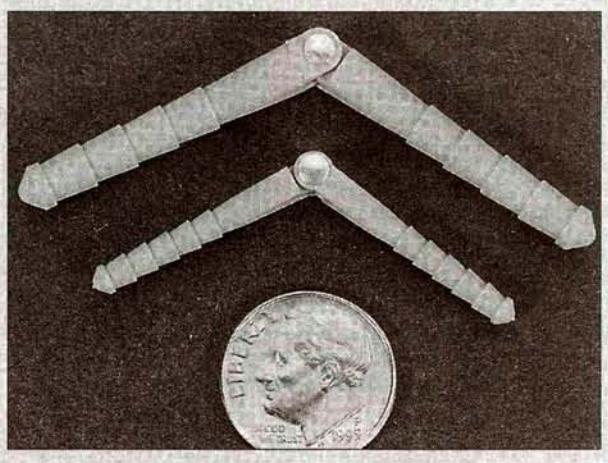
by GERRY YARRISH

MODEL AIRPLANE NEWS HOW TO

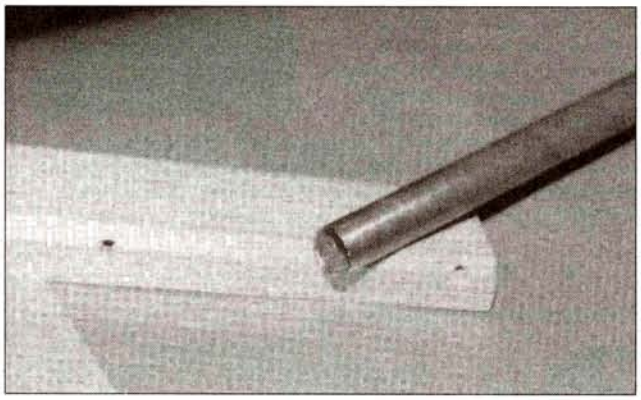
Install Robart hinges in ARC models

LIKE MANY modelers, when I build an aircraft, I have particular hardware preferences. I choose Robart* HingePoint hinges because they are very easy to install and, I think, look more true-to-scale than the standard "flat" hinges.

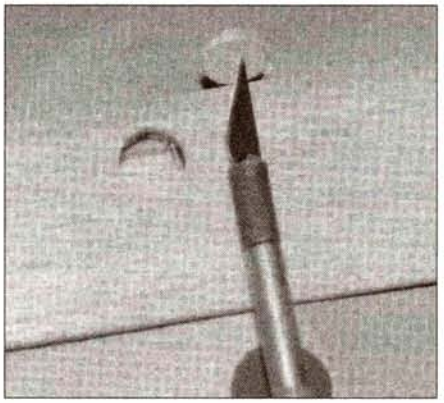
But if you build an almost-ready-to-cover (ARC) kit, you'll have to make a few internal modifications if you want to install HingePoint hinges properly. Here's my quick fix for the ARC hinging problem.



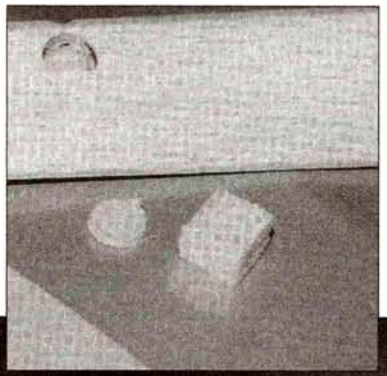
PHOTOS BY GERRY YARRISH & WALTER SIDAS



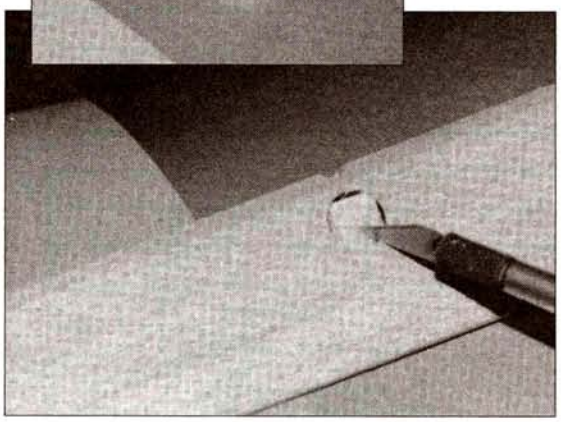
1 *Mark where the hinges will be installed. Inside the control surface, you need enough solid balsa to take the 3/4- to 1-inch-deep hole that you'll drill for each hinge. I install balsa blocks; for each block, I cut an access hole in the control surface's sheeted skin with a sharpened, large-diameter brass tube.*



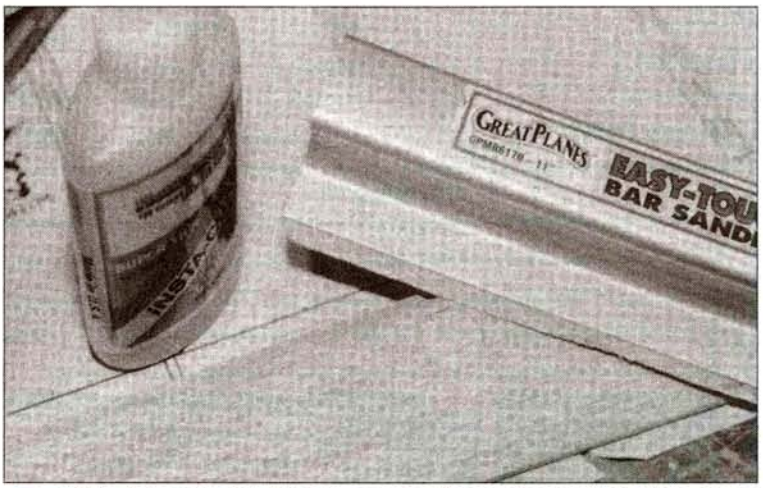
2 *To cut the access hole, gently twist the tube while applying firm pressure. Cut all the way through the balsa, remove the neat little balsa plug from the end of the tube, and save it to close the hole after you've installed the block.*



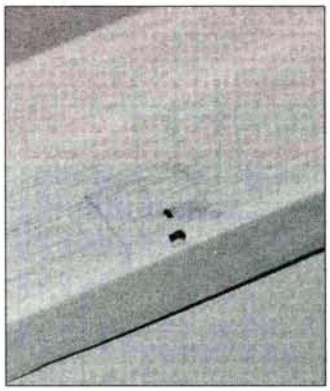
3 *Here are a plug and a balsa block ready to install. Carve the block a little to make it fit the hole: knock off the corners and carve it into a wedge shape.*



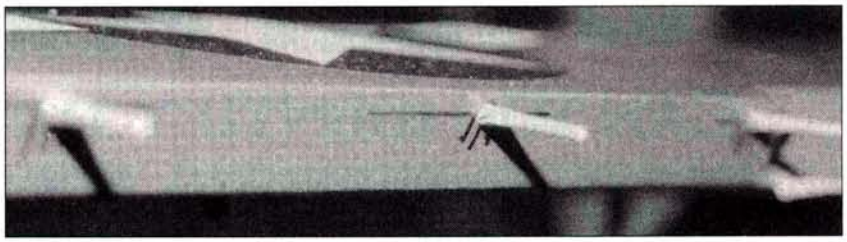
4 *Put the block into the hole, then push it up against the leading edge with a hobby knife, and secure it with thin CA.*



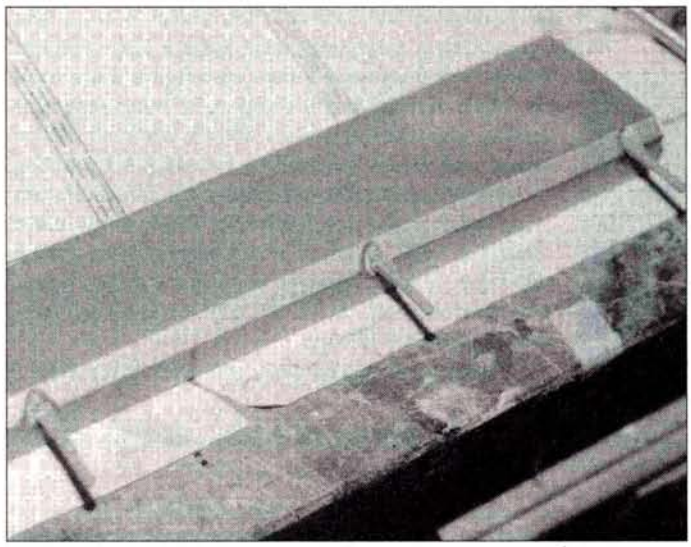
5 *Put the balsa plug into the hole, and glue it into place with CA. Here, I used Bob Smith's* Insta-Cure Super Thin. When this has cured, sand the plug flush with the control surface's outer skin. (A Great Planes* Easy Touch Bar Sander is useful here; I use 220-grit sandpaper.)*



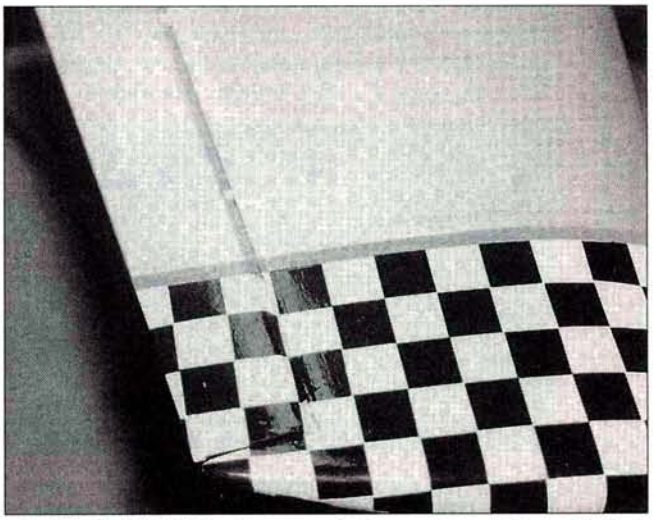
6 *If you need to install larger HingePoints in a giant-scale model, simply use a hobby knife to cut a larger, square opening in the control surface, as shown here. Install a balsa block that's as large as necessary to properly distribute the hinge load.*



7 *With all the balsa blocks glued into place and all the holes closed, it's time to cover the model. To position the hinges properly, draw horizontal and vertical centerlines for each one (I use a Sharpie marking pen). Then drill the holes and fit the hinges temporarily in the wing trailing edge.*



8 *Next, butt the control surface (here, an aileron) against the wing trailing edge, and transfer the hole marks to the control surface's leading edge, so that the holes in the wing and the control surface match. Drill the holes, and temporarily fit the hinges in the control surface. Here's a tip: to minimize the gap between the control-surface leading edge and the wing trailing edge, use a rat-tail file to notch the control-surface leading edge at each hinge location. This allows you to push the hinges farther into the leading edge while allowing them full motion.*



9 *Finally, trial-fit the hinges, and when you're satisfied with their fit, glue them all into place with an alphatic-type glue or Pacer Technology's* new Hinge Glue. Before you install the hinges, be sure to completely coat the inside of the holes with glue. Periodically check the hinges for freedom of movement, and when the glue is dry, install the control horns and linkage.*

So, even though you build ARCs, you can still use Robart HingePoint hinges. The balsa blocks greatly increase the strength of the installations, and remember: if all else fails, improvise!

**Addresses are listed alphabetically in the Index of Manufacturers on page 184.*

Name THAT PLANE

CAN YOU IDENTIFY THIS AIRCRAFT?

If you can, send your answer to *Model Airplane News*, **Name That Plane Contest** (state issue in which plane appeared), 251 Danbury Rd., Wilton, CT 06897-3035.

CONGRATULATIONS to Gene Umbright of St. Louis, MO, for correctly identifying the April '96 issue's mystery plane. The Aqua I Model W-6 amphibian was manufactured in 1948 by Aquaflight Inc. of Wilmington, DE, and the prototype was extensively tested at the Philadelphia Seaplane Base. The Aqua I's chief designer, Meredith C. Wardle, was also the president of the company. The Model W-6—a twin-engine passenger or cargo amphibian—was a high-wing cantilever monoplane with a short sea-wing for water stability. Made of metal and birch plywood, it had retractable landing gear that disappeared into the nose and the sea-wings, and it was powered by two 125hp Lycoming, 4-cylinder engines that had fixed-pitch propellers; constant-speed props were optional. With a fully loaded weight of 3,600 pounds, it would take off from water in 400 yards. It had a wingspan of 36 feet, 6 inches, was 29 feet, 6 inches long and 12 feet high (on land) and had a cruising speed of 125mph.

Thanks to all who wrote in; good luck next month!

The winner will be drawn four weeks following publication from correct answers received (on a postcard delivered by U.S. Mail), and will receive a free one-year subscription to *Model Airplane News*. If already a subscriber, the winner will receive a free one-year extension of his subscription.

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Ace R/C Inc., 116 W. 19th St., P. O. Box 472, Higginsville, MO 64037-0472; (816) 584-7121; fax (816) 584-7761.

Aeroglass; Stephen Weber, Box 24, Port Rowan, Ontario, Canada NOE 1M0; (519) 875-1533.

Astro Flight Inc., 13311 Beach Ave., Marina Del Rey, CA 90292; (310) 821-6242; fax (310) 822-6637.

Balsa USA, P.O. Box 164, Marinette, WI 54143; (800) 225-7287; fax (906) 863-5878.

Balsarite; distributed by Coverite (see address below).

B&B Specialties, 14234 Cleveland Rd., Granger, IN 46530.

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Bob Smith Industries, 8060 Morro Rd., Atascadero, CA 93422; (805) 466-1717; fax (805) 466-3683.

Bob Violett Models (BVM), 170 State Road 419, Winter Springs, FL 32708; (407) 327-6333; fax (407) 327-5020.

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Byron Originals, P.O. Box 279, Ida Grove, IA 51445; (712) 364-3165; fax (712) 364-3901.

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DCU, 1564 S. Anaheim, Unit B, Anaheim, CA 92805.

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Jet Hangar Hobbies, 10595 Bloomfield Ave., Los Alamitos, CA 90720; (310) 493-1285; fax (310) 493-1765.

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Lanier RC, P.O. Box 458, Oakwood, GA 30566; (404) 532-6401; fax (404) 532-2163.

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ADVERTISER INDEX

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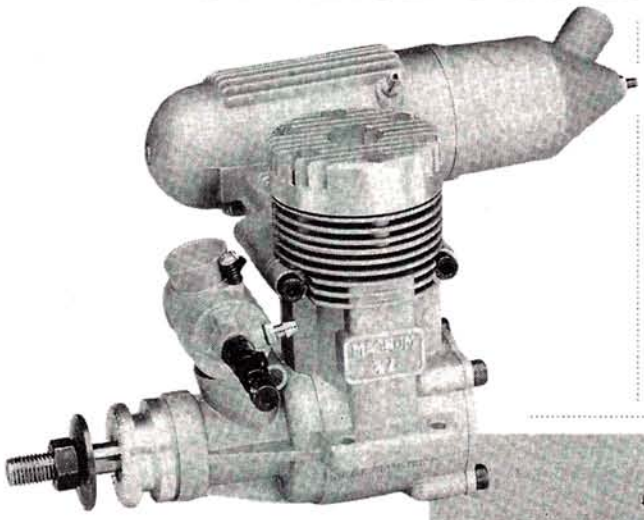

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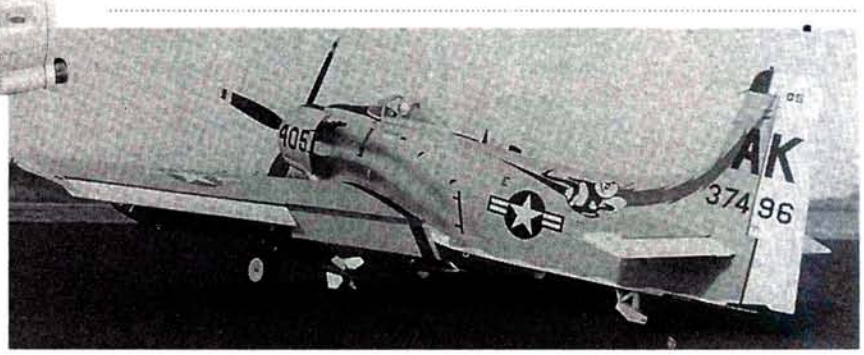

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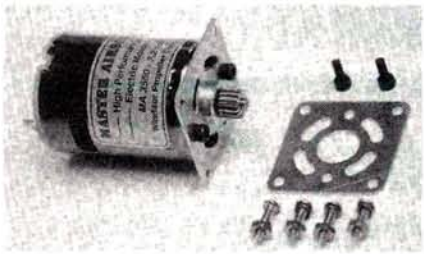

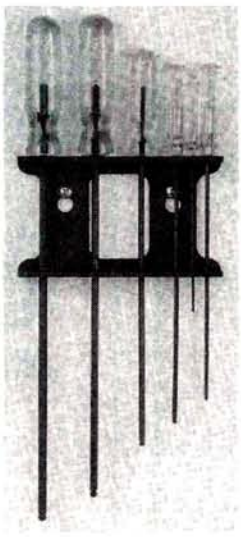

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GIANT-SCALE PLANS BY HOSTETLER. Send SASE to Wendell Hostetler's Plans, 1041 Heatherwood B, Orrville, OH 44667. Phone (330) 682-8896; fax (330) 683-5357. [6/97]

POSTCARDS—plane, tank, car, truck, train, ship assortments. 10 cards—$5. CAA, 1933 Wingate Bishopshead Rd., Toddville, MD 21672. [7/96]

HYDE CUSTOM SOFT MOUNTS: $19.95-$199.95 for engines thru 20 cu. in. F3A World Championship, TOCs and racing winning performance proven by Chip Hyde. Popular sizes: .40—$49.95, .60—$54.95, 1.2—$89.95, 3.7—$99.95, 5.8—$109.95, 8.8—$124.95. $5 S&H. Special thru October 1996—any size mount $100 for TOC and giant-scale racing competitors. Patent 5478044. For additional prices and information: Merle Hyde, 1627 E. Palo Verde, Yuma, Arizona 85365. [9/96]

MODELER'S EXCHANGE NETWORK: Listings of kits, planes, radios, engines and other modeling-related items. "For Sale" or "Wanted" published by region and updated monthly. Turn surplus items into cash, or find that new project quickly and easily. For more information, send $1 and an S.A.S.E. to: M.E.N., P.O. Box 1285, Coventry, RI 02816. [8/96]

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HOBBYIST

PAYING $125 EACH for following toy metal outboard boat motors: Black Mercury MK-1000, Oliver, Seafury Twin, Gale Soverign. Also buying others. Gronowski, 140 N. Garfield Ave. Traverse City, MI 49686; (616) 941-2111. [8/96]

WANTED: Model engines and racecars before 1950. Don Blackburn, P.O. Box 15143, Amarillo, TX 79105; (806) 622-1657. [10/96]

ENGINES: IGNITION, GLOW, DIESEL— new, used, collectors, runners. Sell, trade, buy. Send $3 for huge list to Rob Eierman, 504 Las Posas, Ridgecrest, CA 93555; (619) 375-5537. [11/96]

MAGAZINE BACK ISSUES—*American Modeler, American Aircraft Modeler, Aeromodeller, Model Airplane News, Model Aircraft, RCM* and more; 1930s–1990s. For list, send SASE to Carolyn Gierke, 1276 Ransom Rd., Lancaster, NY 14086. [9/96]

WANTED: ignition model engines 1930s to 1950s, especially Elf, Baby Cyclone, Brown Jr., Ohlsson Custom and Gold Seal. Also model racecars, any parts, spark plugs, etc; Woody Bartelt, 3706 North 33rd, Galesburg, MI 49053; (616) 665-9693, or (800) 982-5464. [10/96]

CASH FOR ENGINES: ignition, glow, diesel–all types; any condition; sale list, too! Estates my specialty! Send SASE for list. Bob Boumstein, 10970 Marcy Plaza, Omaha, NE 68154; (402) 334-0122. [8/96]

WANTED: Old, unbuilt, plastic model kits from '50s and '60s. Send list, price to Models, Box 863, Wyandette, MI 48192. [2/97]

ENGINES, KITS & ACCESSORIES: 35-year collection for sale. For listing send #10 SSAE to: Ed Hagerlin, Box 1980, Overton, NV 89040. [8/96]

MODEL AIRPLANE NEWS, 1930-1980; "Air Trails," 1935-1952; "Young Men," 1952-1956; "American Modeler," 1957-1967; "American Aircraft Modeler," 1968-1975. $1 for list. George Reith, 3597 Arbutus Dr. N., Cobble Hill, B.C. Canada V0R 1L1. [8/96]

COLLECTION FOR SALE: Over 350 kits from 40's, 50's, 60's, F/F, R/C, U/C, Rubber, Solids, Jetex. Send SASE ($.55) to Dr. Frank Iacobellis, 62 Palisade Rd., Rye, NY 10580, or call (914) 967-5550. [8/96]

MODEL MOTORS WANTED: most types, 1970 and earlier. Cash or trade. T. Crouss, 100 Smyrna, West Springfield, MA 01089. [12/96]

WANTED: Cox, Wen-Mac, Testors, etc. Gas-powered plastic cars, planes, boats. Please call or write. Dean Barham, 4032 Iowa St., San Diego, CA 92104; (619) 528-1680. [7/96]

SLOT CARS WANTED: Cox, Aurora, Tyco, etc. 1960's, 1970's vintage; any scale. Please call or write. Dean Barham, 4032 Iowa St., San Diego, CA 92104; (619) 528-1680. [7/96]

P-38 LIGHTNING—LOVE IT? Join a group of P-38 modeling and full-size enthusiasts. Share modeling, flying, historic facts and articles about the P-38. Entering fee of $15 covers newsletters and club patch. For more information, write: P-38 M.O.I. Ron Parker, 3003 Windchase, #1003, Houston, TX 77082-3444. [10/96]

WANTED: Model engines and racecars before 1956. Don Blackburn, P.O. Box 15143, Amarillo, TX 79105; (806) 622-1657. [12/96]

WANTED: Built or partially built scale Cessna 150, 152, or 172. Glen Mills, P.O. Box 3393, Mission Viejo, CA 92690; phone (714) 768-0585; fax (714) 458-6455. [12/96]

EZ PILOT ARFS WANTED: (512) 918-0147. [8/96]

WANTED: Pre-1950 miniature gas-powered racecars, Bremner, Dooling, O&R, Thimbledrone, McCoy, etc. Also toy metal outboard boat motors: Gale, Oliver, Mercury, etc. Gronowski, 140 N. Garfield Ave., Traverse City, MI 49686. (616) 941-2111. [8/96]

HERCULES MODEL TUG BOAT—36 inches long, steam powered (Saito 2-cylinder) forward and reverse, steam whistle, smoker, never used, display case—$2,995. For more information, call weekdays, John Wanner (602) 948-2720. 7595 E. Gray Rd., Scottsdale, AZ 85260. [7/96]

BUYING 60'S AND 70'S TOYS: GI Joe, plastic models, Hot Wheels, TV and monster-related, other cool toys. Jeff Gilbert, 423 S. Randolph St., Princeton, IL 61356-1960, (815) 875-1653. [9/96]

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EVENTS

"T.O.C. OF BALTIMORE" FLY IN: Two-day extravaganza—June 22 and 23. Open flying—Saturday; Demo flying—Sunday. Scheduled appearances by world class competitors. Prizes. Raffles. Call Art Vail (410) 247-4281. [7/96]

MODEL HOBBIES SHOW AND SALE: July 13, 9 a.m. to 4 p.m., Bellflower Masonic Hall, 9813 Beach Street, Bellflower, California. Admission—$4, sale table—$40. Caryl Sitter, 13674 Bennington Court, Fontana; (909) 899-4561. [7/96]

CORONA, CA. MAIN EVENT SHOW—2180 Nevada, (South McKinley, off 91 fwy.) July 26-28. Friday, 5 p.m. - 10 p.m. Sat/Sun 10 a.m. - 5 p.m. Free admission; (909) 371-4451. [7/96]

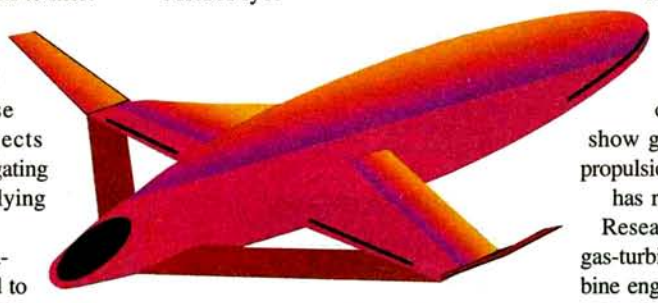
NCFFA NATIONAL FUN-FLY CONTEST- August 10-11, 1996, in Calisle, PA. Sportsman and Unlimited Classes in NCFFA and Fun Fly categories. NCFFA and Fun Fly events, with trophy and merchandise awards. AMA and NCFFA membership required. Pre-registration via mail or at site before contest starts at 8 a.m. on Saturday. Send SASE to Contest Director: Mark Smith, 1020 Forbes Rd., Carlisle, PA 17013, for rules and info. [8/96]

R/C FLYING BUGS

Imagine an unmanned aerial vehicle (UAV) that is small enough to fit in the palm of your hand and fly unnoticed into buildings, down hallways and into rooms where it can attach itself to the ceiling or wall to covertly relay information about the activity in that room to the eager eyes and ears of spies parked in a van just outside. Or consider even tinier UAVs the size of a microchip that float on wind currents, modify their trajectory to converge en masse on some radiating source, such as an enemy radar installation and then enter through cooling vents to short-circuit the site's electronics. Science fiction? Well, lock your doors and close your vents because the Defense Advanced Research Projects Agency (DARPA) is investigating the feasibility of just such flying automatons.

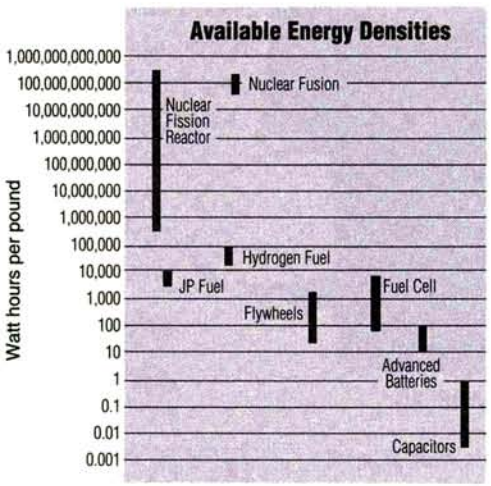
Last November, a DARPA-sponsored workshop was held to assess state-of-the-art technology, understand relevant defense applications and collect data required to underpin a Micro Unmanned Aerial Vehicle (MUAV) Program. The results of that workshop have intensified interest in the feasibility and role of MUAVs in future military applications.

At the workshop, various critical MUAV technologies were discussed. Ideas advanced were battery-operated micro motor-driven UAVs (Lincoln Labs and the U.S. Naval Research Laboratory), micro gas-turbine engines (MIT), image-understanding microchip optical sensors (Georgia Institute of Technology), electromechanical "smart skin" actuators (SARCOS) and a novel micro-pulse, jet-driven air vehicle with no moving control surfaces (Georgia Tech Research Institute). The latter design would employ a microelectromechanically based tiny pulse jet as a gas generator for not only primary propulsive thrust, but also to create motionless actuators that rely on circulation-controlled airfoils (see figure). Study of the problems associated with building pulse jets at this scale in support of a circulation-controlled "MicroFlyer" is being undertaken at the Georgia Tech Research Institute by Principal Research Engineer Robert Michelson. Michelson is also past president of the Association for Unmanned Vehicle Systems (AUVS) and the originator of the annual International Aerial Robotics Competition.



MICROFLYER POWER SYSTEMS

Three technological hurdles—navigation, energy storage and propulsion—must be surmounted before MicroFlyers will be ready for commercialization. Navigation will be the most difficult problem because of the non-scaling physics of electromagnetic radiation: you can't drastically miniaturize a Global Positioning Satellite System (GPS) antenna! Propulsion and energy storage systems under development are intimately related. No battery has been able to match the energy that can be released as matter is transformed from one state to another ("burning"). Therefore, the first MicroFlyers may well use miniature internal-combustion engines rather than battery-operated motors (see Energy Density chart).



Micro-electric motors used by the camera and pager industries are being tested for MicroFlyers. These tiny 2-gram motors have generated 2 grams of static thrust while consuming 40mW of electric power. Oak Ridge National Laboratories has demonstrated a rechargeable thin-film lithium battery with a voltage of 1.5 to 4.2 volts and a specific energy of 0.8 to 1.6 megajoules per kilogram (MJ/kg). To put this in perspective, a 1994 Rand study postulates the power requirement for a 1cm, 1-gram (*really tiny!*) MicroFlyer will be 45mW if one third of the air vehicle's gross weight is devoted to a 1.6MJ/kg battery.

On the other hand, internal-combustion engines seem to show greater promise for MicroFlyer propulsion. MIT's gas-turbine laboratory has received funding from the Army Research Office to develop a micro gas-turbine generator. This tiny gas-turbine engine will weigh in at 1 gram and will be 10mm in diameter x 3mm long. The initial fuel will be gaseous hydrogen, though later operation on JP8 will be attempted. This is not simply a scaled-down jet engine, but a whole new design with gas bearings, silicon carbide components and a rotational speed of *3 million rpm*. This was originally to be a battery replacement, driving a tiny 10W to 20W electric generator. Used as a turbojet, however, it should develop up to 0.05 pounds of thrust. Compared to a heli engine having a 5:1 power-to-weight ratio, the tiny MIT gas-turbine engine will be four times more impressive.

Taking a different tack, the Georgia Tech Research Institute is looking at tiny pulse-jets. These pulse-jets would act either as primary propulsion or as gas generators for "blown" airfoils. Microelectromechanical system (MEMS) technology—machines on the scale of several transistors on an integrated circuit chip—will be used to reduce the losses owing to boundary-layer effects that will occur in a centimeter-scale combustion chamber. We'll keep you posted on further developments in the world of R/C MicroFlyers.

Our thanks to Rob Michelson for his help in preparing this article.

—Tom Atwood